492

RELEASES AND RECOVERIES OF DRIFT BOTTLES AND CARDS IN THE CENTRAL PACIFIC

By Richard A. Barkley, Bernard M. Ito,
and Robert P. Brown

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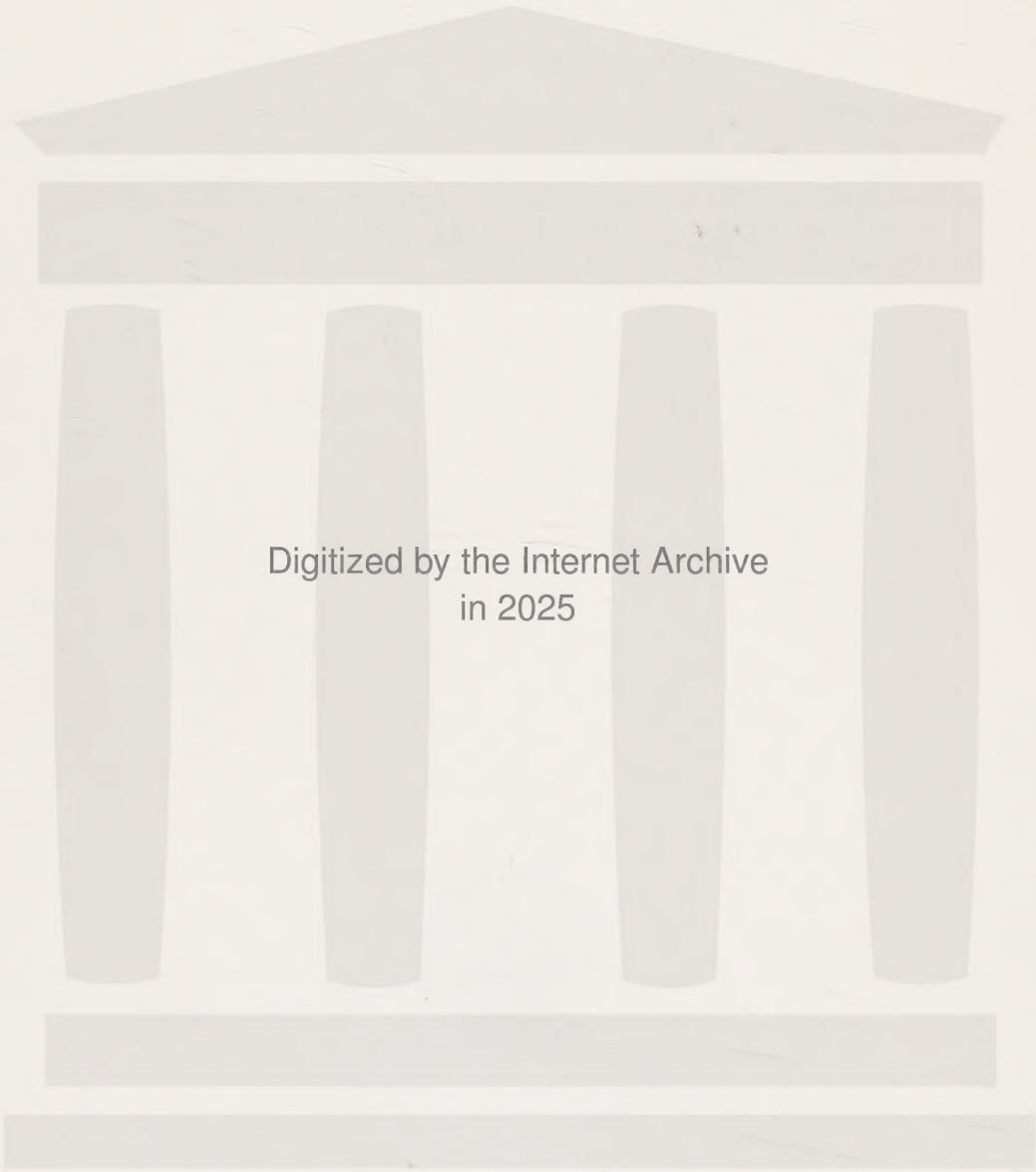

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RELEASES AND RECOVERIES OF DRIFT BOTTLES AND CARDS IN THE CENTRAL PACIFIC

By

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ABSTRACT

Since January 1961, the Bureau of Commercial Fisheries Biological Laboratory in Honolulu has been releasing drift bottles and cards in the central Pacific Ocean. Data are presented on all releases and recoveries through June 1963, together with charts showing the release and recovery points. An analysis of the returns from the Hawaiian Islands shows that there is a seasonal change in the direction and speed of the current system near the Islands which coincides with changes in strength of the trade wind system. During the first half of the year the current moves at speeds of between 6 and 11 nautical miles per day and near Oahu and Kauai it moves toward the northwest, while in the latter half of the year the speed is 6 nautical miles per day or less, and the direction of flow is toward the west or somewhat south of west.

INTRODUCTION

In 1961 the Bureau of Commercial Fisheries Biological Laboratory in Honolulu began a series of drift bottle releases designed primarily to obtain more complete and detailed information on the currents near the Hawaiian Islands than was then available. It was clear that such information was required in order to interpret various kinds of oceanographic and biological information collected by the Laboratory near the Islands, and drift bottle techniques offered a means for obtaining considerable information in an economical way, preliminary to the use of more sophisticated and expensive procedures.

At that time, the information on surface and near-surface currents near the Hawaiian Islands consisted primarily of oceanographic station data taken by the Laboratory a decade earlier (McGary, 1955; Seckel, 1955), together with data on surface drift obtained from ship's log books (H. O. Publication nos. 570, 1947; and 569, 1950).

The dynamic topography of the sea surface near the Hawaiian Islands (McGary, 1955; Seckel, 1955) is characterized by an irregular series of eddies which vary considerably in size, number, and location. The eddies tend to obscure the patterns of mean flow, and because little is known about the growth and decay of such eddies, or of their movements, the information on mass transport which can be derived from the dynamic topography is valid for intervals of time of the order of a few days only.

Current charts based on ship's drift provide information on a monthly basis, and thus offer some continuity in time. However, the data are averaged over a number of years and over areas of 1 degree of latitude and longitude, so that the details of currents on a scale comparable to that of the individual islands are lost, since even Hawaii, the largest of the islands, is less than 60 nautical miles in mean diameter.

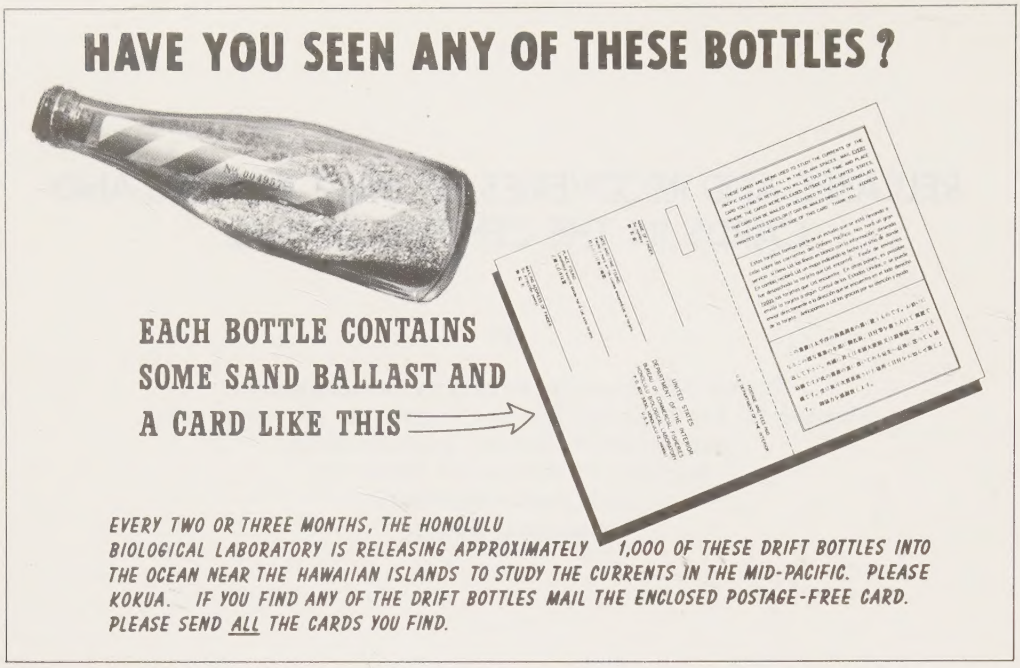
HAVE YOU SEEN ANY OF THESE BOTTLES?
EACH BOTTLE CONTAINS SOME SAND BALLAST AND A CARD LIKE THIS
EVERY TWO OR THREE MONTHS, THE HONOLULU BIOLOGICAL LABORATORY IS RELEASING APPROXIMATELY 1,000 OF THESE DRIFT BOTTLES INTO THE OCEAN NEAR THE HAWAIIAN ISLANDS TO STUDY THE CURRENTS IN THE MID-PACIFIC. PLEASE KOKUA. IF YOU FIND ANY OF THE DRIFT BOTTLES MAIL THE ENCLOSED POSTAGE-FREE CARD. PLEASE SEND ALL THE CARDS YOU FIND.

Figure 1.--Poster showing drift bottle and enclosed card. These posters were placed in schools and other public buildings to alert potential finders.

DESCRIPTION OF BOTTLES AND CARDS

Drift bottles were used initially, but were gradually replaced by drift cards during 1961. The drift bottle consisted of an 8-ounce clear glass bottle, ballasted with sand so that an inch of the neck protruded above the water (fig. 1). Cards were enclosed which contained instructions to the finder in English, Spanish, and Japanese, with a postcard attached which could be torn off for mailing (fig. 1). The postcards were numbered, postage paid, and self-addressed with blank spaces for the name and address of the finder and the time and place of recovery. The back of the card was printed with wide International Orange stripes to catch attention. These cards were folded up and wrapped once with pressure-sensitive tape to facilitate insertion in the bottle and to permit the finder to remove the card easily. The bottles were sealed with waxed corks.

In 1962 some experiments with drift cards sealed in plastic envelopes showed that the cards performed as well as the bottles and were much more convenient to store and use. The drift card consisted of a numbered, bright red postcard similar to that used in the bottles, but with the instructions to the finder printed on the back of the card (fig. 2). A weight was enclosed to make the card float vertically in the water so that its movements, like those of the bottles, would depend primarily on the currents in the uppermost 6 inches of the water column. The drift cards were sealed in polyethylene bags and then packaged in flimsy waxed-paper bags, in groups of 20, to ensure control of the serial number sequence and the number of cards per release; the waxed-paper bags were selected for their ability to come apart in the water in a minimum time, usually about 2 to 3 minutes.

The cost per bottle was estimated at 10 cents; the drift cards cost 11 cents each.

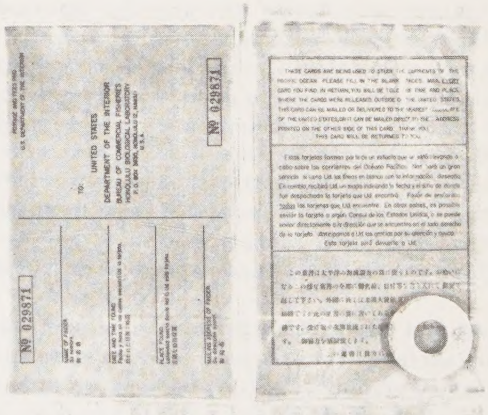

Figure 2.--Drift card used in this study.

NEW DRIFT CARD DESIGN

With experience in the manufacture and use of the drift cards described above, it became apparent that considerable improvement in the design was possible. Although none of the data presented herein were obtained with the new type of drift card, the new card will be illustrated and its manufacture briefly described because it represents a significant improvement in design which may be of value to others who are considering the use of drift cards.

Figure 3.--New drift card design.

The important characteristics of the design (fig. 3) are:

1. A strip of metal ballast whose center of gravity is always near the long axis of the card, so that the card does not tend to float with one corner higher than the other, presenting an unbalanced area to the wind.

2. The absence of significant amounts of air in the card's compartment, so that the buoyancy can be concentrated at the end opposite the ballasted edge.

3. A controlled volume of air in a separate compartment of the plastic envelope, which virtually eliminates the possibility of sinking or of exposing too much area to the winds.

These cards are manufactured by placing the card and metal ballast strip in a polyethylene bag of 6-mil thickness, squeezing the card-filled portion between spring-loaded metal plates to remove the air, and sealing the upper edge of the card compartment. This leaves a 1-inch pocket at the upper end of the plastic bag, into which is inserted a length of soda straw cut to fit the width of the bag. When the upper compartment is sealed, the card is finished and ready to be placed in its waxed-paper bag with 19 other cards. All cards of this design floated upright without tilting, with a waterline at a level with the soda straw, exposing a uniform half-inch of the upper edge above water. The cost per card is 14 cents in quantity lots.

DRIFT BOTTLE AND CARD RELEASES AND RETURNS

Drift bottles, and later drift cards or cards and bottles together, were released whenever feasible by the Laboratory's research ship, the Charles H. Gilbert, beginning with cruise 51 in January 1961. In addition, the U. S. Coast and Geodetic Survey ship Surveyor released almost 3,000 cards during two cruises early in 1963, when that ship was working to the north of Midway Island, and a few bottles were released near Oahu in September 1961 by the M/V Broadbill, a fishing vessel then under charter to the Laboratory.

The releases are listed in the Appendix, which shows the cruise number (except in the cases of the Surveyor and Broadbill releases), the sequence number of the release, the number of bottles and/or cards in each release, and the date and location of the release. Initially there were 10 bottles in each release, but this number was later increased to 20 to improve the chances of multiple recoveries. On various occasions the number of bottles or cards per release were modified, and these exceptions are also noted in the tables.

The Appendix also shows the number of recoveries, if any, per release, as well as the date of each reported return, and the location where the bottle or card was found.

No reward was offered for reporting returns. The finder was sent a letter which thanked him for his assistance and outlined the project objectives, which told him when and where the bottle or card which he found had been released, and which also contained information on the minimum speed and the distance covered. Enclosed with each such letter was a chart showing the release point and the presumed path of the bottle or card, as well as the postcard mailed by the finder in reporting the recovery.

RESULTS

From January 1961 to June 1963, a total of 16,285 bottles and cards were released, and by January 1964 a total of 538 returns had been reported. This represents a recovery rate of 3.3 percent, which is remarkably high considering the ratio of the area covered by releases to the coastline available in the mid-Pacific. It can be compared, for example, with the return rate of 4.6 percent reported by Schwartzlose (1963) for releases off southern California.

On the island of Oahu, where some 80 percent of the population of the State of Hawaii lives, the timing of returns suggests that almost no bottles or cards remain undetected on land for more than about 1 day, which considerably enhances the reliability of the minimum velocities which can be computed from the time the drift bottle or cards spent in the water and the minimum distance covered. These minimum velocities range from less than 1 mile per day to about 15 miles per day, but within this range there are fairly distinct groups of speeds which appear to be characteristic of seasonal current patterns and of the distance traveled by the drift bottle or card. For returns to the islands of Oahu and Kauai, which represent the largest samples, the frequency distribution of computed minimum velocities shows modes at speeds of about 10 miles per day, 6 miles per day, 3 miles per day, and less than 1 mile per day. Table 1 shows the relationship between these characteristic modes in the velocity spectrum and the time of year and the distance traversed.

Table 1.--Most frequently occurring drift bottle and card speeds (miles per day) as a function of distance and time of year

Time of year	Distance (miles)		
	1 - 10	10 - 100	Over 100
Jan. to June	1/2, <u>3</u>	<u>1/2</u>, 3, <u>6</u>	)
July to Dec.	<u>3</u>, 9	<u>6</u>, 11	) <u>6</u>, 9)

Note: The underlined values represent the dominant modal speeds in each case.

The sample sizes on which table 1 is based are about 50 returns in each case, except for the two sets of values for distances of 100 miles or less from July to December, each of which has more than 100 returns represented in it. The 49 returns from distances greater than 100 miles were not enough to permit breakdown by time of year.

The choice of time periods in table 1 is based on a distinct seasonal pattern in the direction of travel of the drift bottles and cards. Figures 4 through 9 show the locations of releases and recoveries, together with the inferred trajectories. The data are grouped by season, except for the period from April to June, where it was possible to chart returns by month. Figure 10 shows the returns from releases outside of the immediate vicinity of the Hawaiian Islands. All releases are shown in figures 4 through 10 as dots; releases with returns have trajectories associated with them. In cases where more than one return resulted from a release, only one trajectory is shown, unless the recovery points were relatively widely separated. Trajectories were drawn using the convention that trajectories from near-simultaneous releases cannot cross; in figure 10, the trajectories were drawn with the aid of the Atlas of Surface Currents (H. O. Publication no. 570, 1947).

During Charles H. Gilbert cruises 58 and 63, in July 1962 and January to March 1963, respectively, both drift bottles and cards were released simultaneously. This was part of a series of tests to determine the relative effectiveness of the two packages. Essentially the same proportions of both bottles and cards were reported found, and there was no significant difference in the directions of movement, so that the two packages were considered equivalent in performance.

DISCUSSION

The velocity figures shown in table 1 suggest a seasonal change in the velocity of the North Pacific Equatorial Current in the latitude of the Hawaiian Islands. In the early part of the year there was little evidence of speeds of drift of more than 6 nautical miles per day; later in the year, and particularly in returns from more than 10 nautical miles away, there was a considerable proportion of returns with minimum velocities of from 9 to 11 nautical miles per day.

This change in speed coincides with a change in the direction of drift. Figures 4 through 6 show that most recoveries during the first half of the year came from releases made to the south of the recovery points, so that the bottles and cards must have been carried north through the inter-island channels before coming ashore on the windward (northeast) coasts of the Islands. Figures 7 and 8, on the other hand, show a much

greater proportion of returns from releases to the east. Thus, a change in the angle of incidence of the current relatively near shore must take place about June; before then, the drift is roughly parallel to the Islands, with a considerable northward component, while later in the year the flow is primarily from the east or northeast. The evidence for this change is particularly clear when figure 4 is compared with figures 7 and 8, because the periods represented on these charts all contain releases made northeast of the Islands.

As might be expected, the change in the speed and direction of drift with time of year coincides in a general way with the changes in the North Pacific trade wind system. In October through April the windspeeds are lower and light, variable winds are more frequent than in May through September, when the winds exceed 14 miles per hour 50 percent of the time, and 80 to 95 percent of the time are from the northeast quadrant (Blumenstock, 1961).

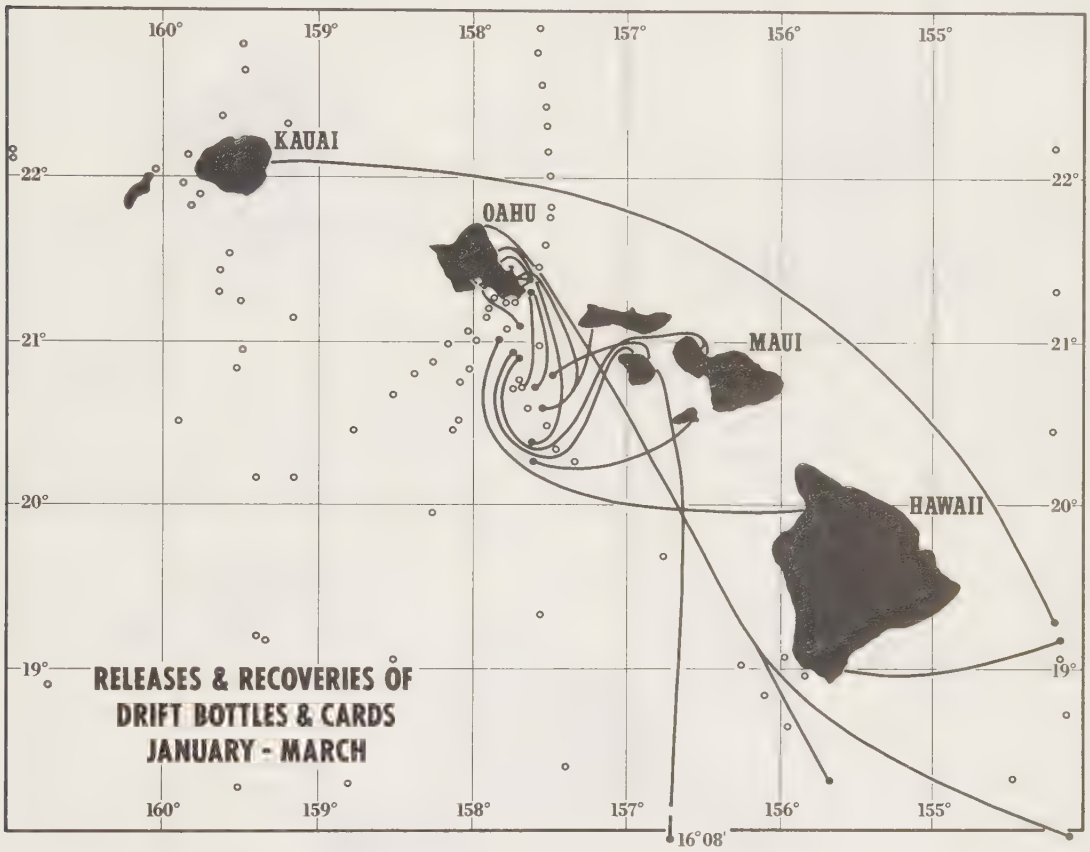

Figure 4.--Reported returns of drift bottles and cards, January - March.

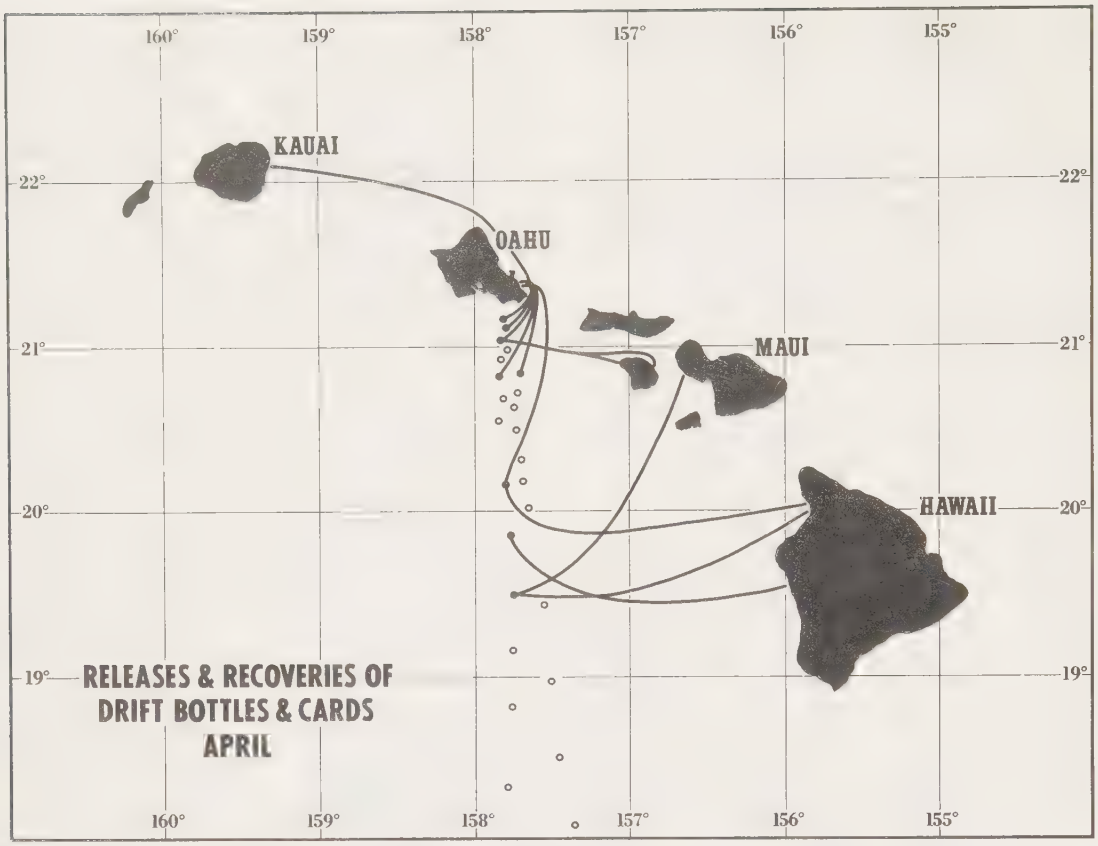

Figure 5.--Reported returns of drift bottles and cards, April.

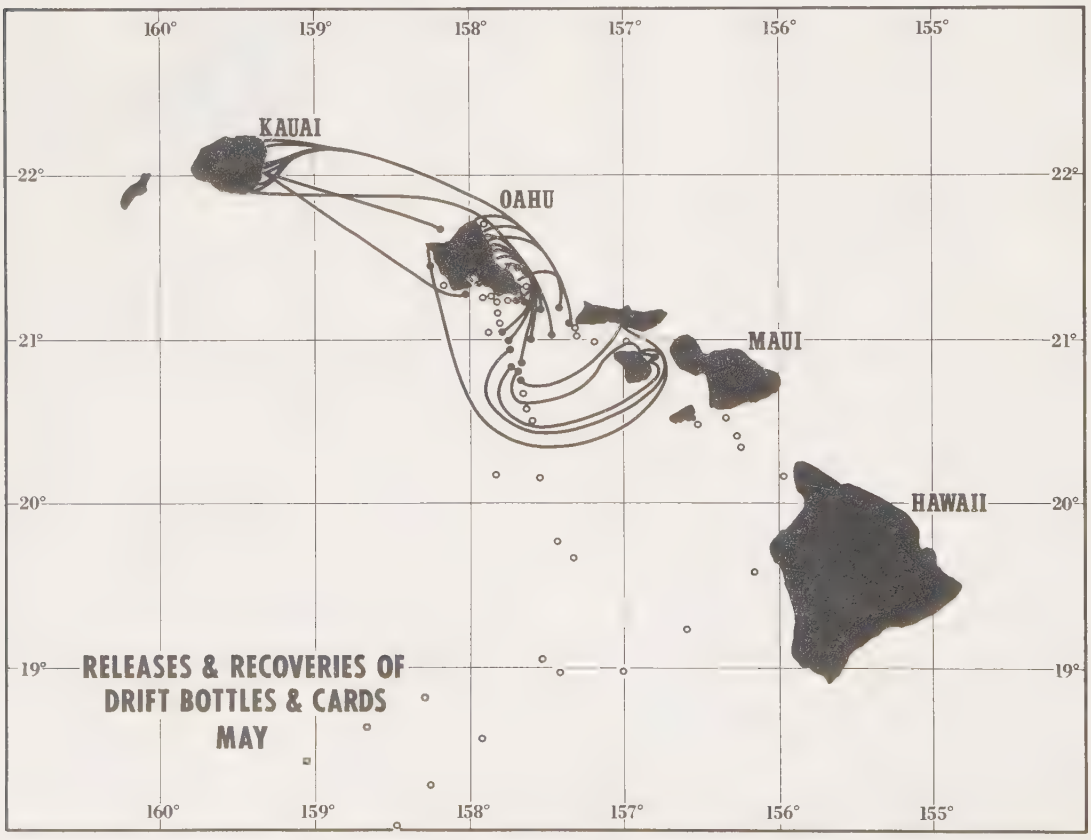

Figure 6.--Reported returns of drift bottles and cards, May.

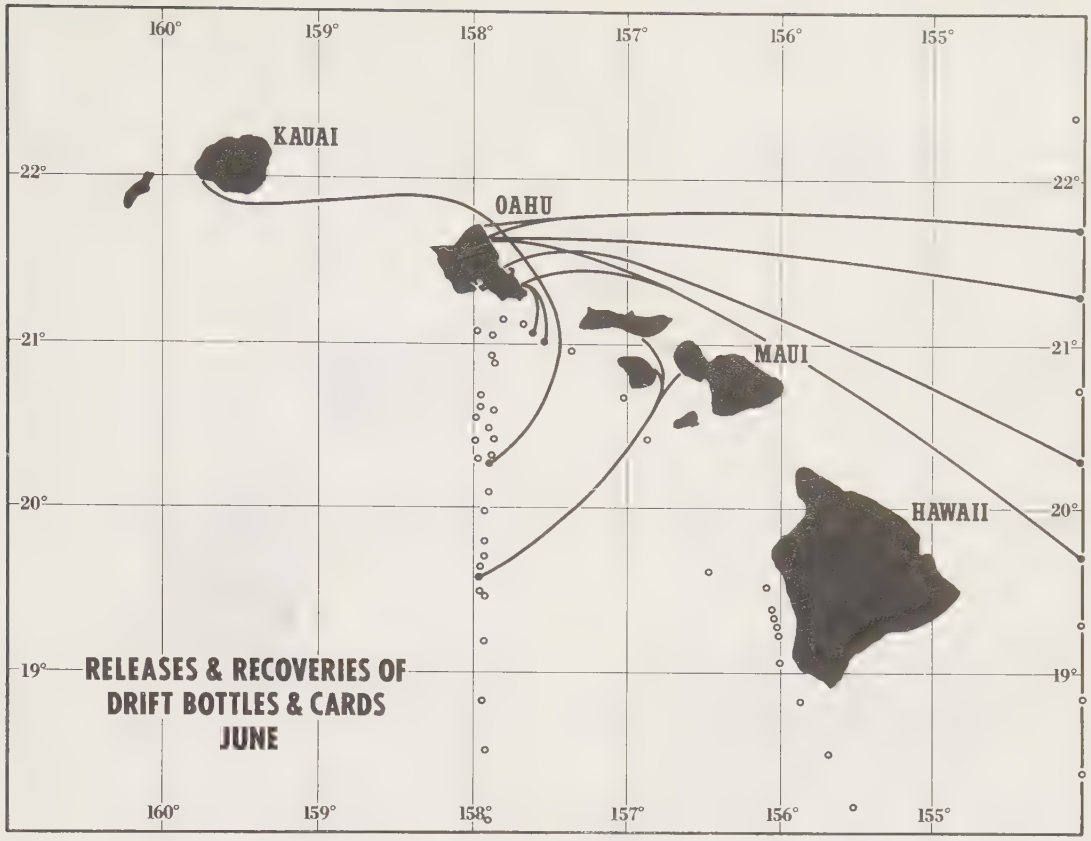

Figure 7.--Reported returns of drift bottles and cards, June.

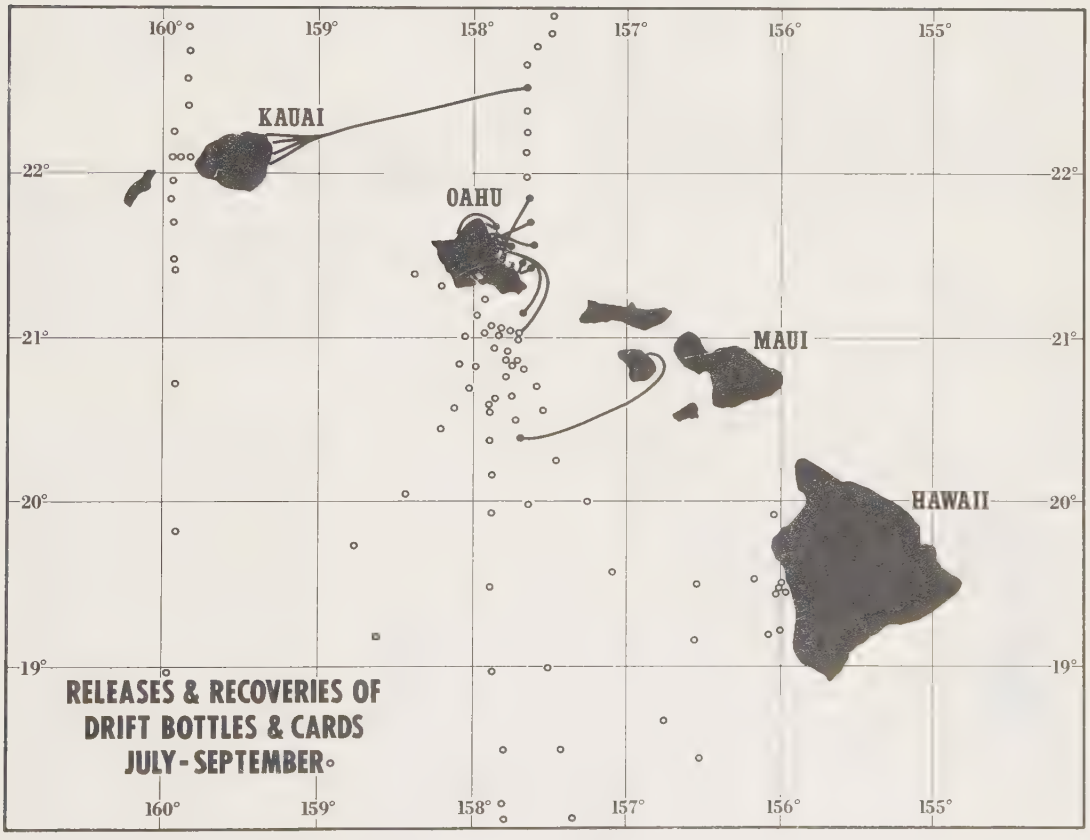

Figure 8.--Reported returns of drift bottles and cards, July - September.

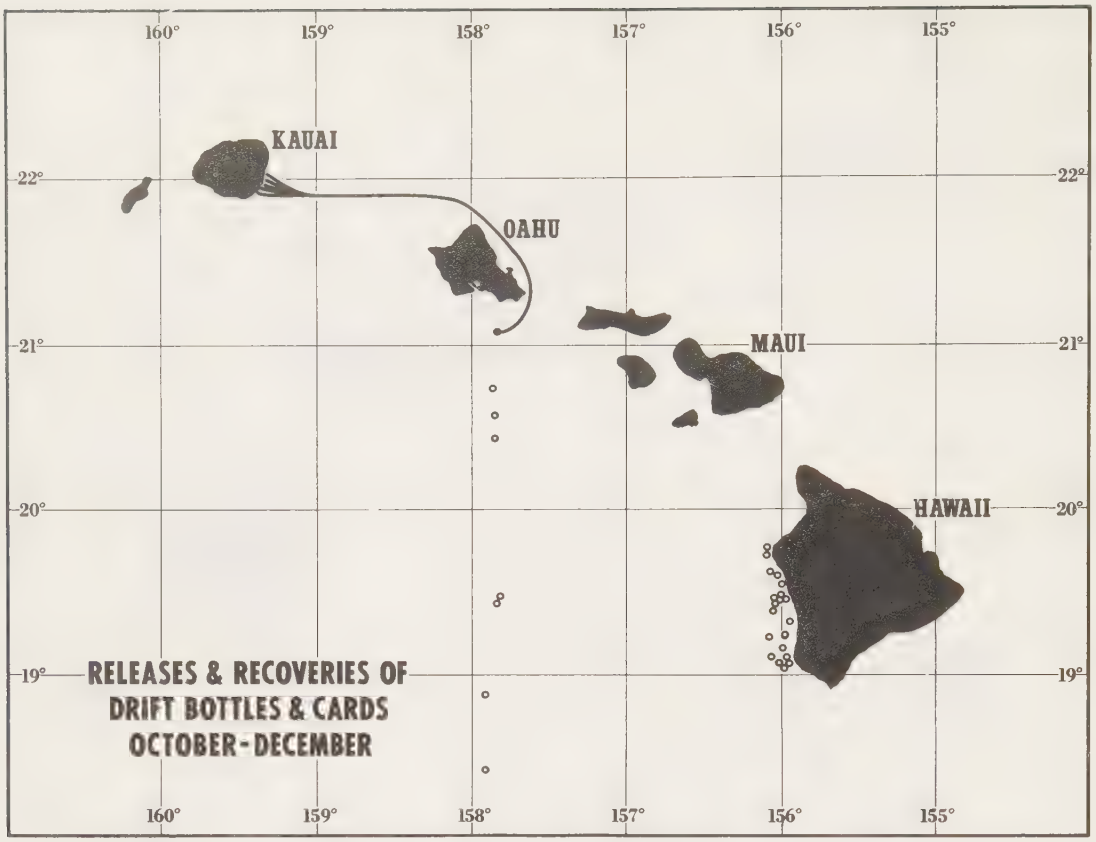

Figure 9.--Reported returns of drift bottles and cards, October - December.

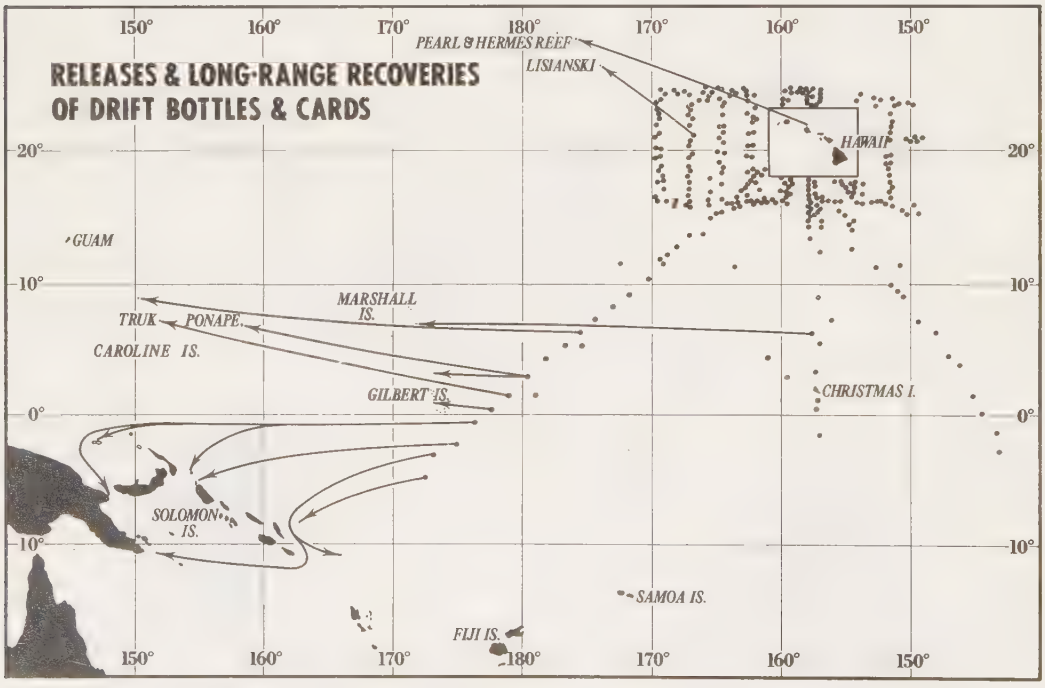

Figure 10.--Returns of drift bottles and cards reported from outside the Hawaiian Islands.

SUMMARY

1. From January 1961 through June 1963, a total of 16,285 drift bottles and cards were released in the central and western Pacific Ocean, the majority in the vicinity of the Hawaiian Islands.

2. By January 1964 there had been 538 returns.

3. The pattern of recoveries from the Hawaiian Islands suggests that the current system near the Islands varies seasonally in strength, with velocities during May to September of about 6 to 11 nautical miles per day, and 6 nautical miles per day or less during October to April, as computed from minimum speeds of drift of both bottles and cards.

4. The pattern of recoveries also suggests a seasonal change in the direction of drift in the immediate vicinity of Oahu; from January to May the drift was predominantly to the northwest, roughly parallel to the Island chain, while during June to December the drift was primarily to the west or somewhat south of west.

5. In general, the pattern of surface drift, and its speed, coincide with the seasonal changes in strength of the trade wind system.

ACKNOWLEDGMENTS

The captain and the crew of the U. S. Coast and Geodetic Survey ship Surveyor assisted in releasing drift cards. Many others cooperated in reporting recovered bottles and cards.

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APPENDIX

The following table contains data on drift card and bottle releases and recoveries from January 1961 to June 1963. The data are grouped by the cruise on which the releases were made and are presented in the chronological order of the cruises.

CHARLES H. GILBERT CRUISE 51 - Jan. 12 - Feb. 28, 1961

Bottles (10 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
51-1	1/18/61	21°03'	157°45'					
51-2	1/18/61	20°55'	157°42'	4	1/24/61	20°55'	156°29'	Maui
				1	2/25/61	21°43'	157°59'	Oahu
51-3	1/18/61	20°43'	157°37'	1	4/16/61	21°34'	157°53'	Oahu
51-4	1/18/61	20°36'	157°34'	1	2/ 5/61	21°06'	157°14'	Molokai
				1	2/22/61	21°24'	157°45'	Oahu
51-5	1/18/61	20°29'	157°32'					
51-6	1/18/61	20°21'	157°28'					
51-7	1/18/61	20°15'	157°21'					
51-8	1/18/61	19°42'	156°47'					
51-9	1/19/61	19°02'	156°17'					
51-10	1/19/61	18°51'	156°07'					
51-11	1/19/61	18°40'	155°58'					
51-12	1/19/61	18°19'	155°40'	1	2/19/61	21°34'	157°53'	Oahu
				1	2/25/61	21°43'	157°59'	Oahu
51-13	1/19/61	17°39'	155°05'					
51-14	1/19/61	16°56'	154°31'					
51-15	1/20/61	16°17'	154°01'					
51-16	1/20/61	15°56'	153°14'					
51-17	1/20/61	16°03'	152°25'					
51-18	1/20/61	16°09'	151°53'					
51-19	1/21/61	16°40'	151°35'					
51-20	1/21/61	17°37'	151°40'					
51-21	1/21/61	18°26'	151°43'					
51-22	1/21/61	18°58'	151°43'					
51-23	1/22/61	19°53'	151°46'					
51-24	1/22/61	20°51'	151°36'					
51-25	1/22/61	21°39'	151°28'					
51-26	1/22/61	22°10'	151°21'					
51-27	1/23/61	23°04'	151°10'					
51-28	1/23/61	23°47'	151°19'					
51-29	1/23/61	23°47'	152°03'					
51-30	1/23/61	23°52'	152°49'					
51-31	1/24/61	23°58'	153°36'					
51-32	1/24/61	23°02'	154°11'					
51-33	1/24/61	22°10'	154°12'					
51-34	1/25/61	21°18'	154°12'					
51-35	1/25/61	20°26'	154°12'					
51-36	1/25/61	19°18'	154°10'	1	8/13/61	22°04'	159°19'	Kauai
51-37*	1/25/61	19°24'	154°10'					
51-38	1/25/61	19°11'	154°09'	1	2/25/61	18°58'	155°36'	Hawaii
51-39	1/25/61	18°44'	154°08'					
51-40	1/26/61	17°58'	154°06'	1	6/ 6/61	21°20'	157°42'	Oahu
51-41	1/26/61	17°33'	154°06'					
51-42	1/26/61	17°09'	154°08'					
51-43	1/26/61	16°15'	154°11'					
51-44	1/26/61	16°05'	154°58'					
51-45	1/27/61	16°06'	155°50'					
51-46	1/27/61	16°08'	156°44'					
51-47	1/27/61	16°49'	157°07'					

*20 bottles released

CHARLES H. GILBERT CRUISE 51 - Jan. 12 - Feb. 28, 1961--Con.

Bottles (10 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
51-48	1/27/61	17°30'	157°13'					
51-49	1/27/61	17°39'	157°16'					
51-50	1/28/61	18°25'	157°24'					
51-51	1/28/61	19°21'	157°34'					
51-52	1/28/61	20°14'	157°37'	1	3/26/61	21°22'	157°42'	Oahu
				1	2/10/62	20°31'	156°34'	Kahoolawe
51-53	1/28/61	20°24'	157°36'	1	2/18/61	21°22'	157°42'	Oahu
				1	2/22/61	21°24'	157°45'	Oahu
				1	2/22/61	21°28'	157°48'	Oahu
				1	2/22/61	21°22'	157°42'	Oahu
51-54	1/28/61	20°36'	157°39'					
51-55	1/28/61	20°44'	157°42'	1	3/ 7/61	21°17'	157°42'	Oahu
				1	3/21/61	20°49'	156°49'	Lanai
51-56	1/28/61	20°54'	157°46'	1	4/ 8/61	20°54'	156°54'	Lanai
51-57	1/28/61	21°04'	157°48'	1	3/ 8/61	20°00'	155°50'	Hawaii
51-58	2/ 1/61	21°09'	157°56'					
51-59	2/ 1/61	21°01'	157°59'					
51-60	2/ 1/61	20°51'	158°02'					
51-61	2/ 1/61	20°45'	158°04'					
51-62	2/ 1/61	20°31'	158°07'					
51-63	2/ 1/61	20°27'	158°09'					
51-64	2/ 1/61	19°59'	158°17'					
51-65	2/ 1/61	19°04'	158°32'					
51-66	2/ 2/61	18°19'	158°49'					
51-67	2/ 2/61	17°30'	159°08'					
51-68	2/ 2/61	16°45'	159°20'					
51-69	2/ 2/61	15°58'	159°32'					
51-70	2/ 3/61	16°05'	160°22'					
51-71	2/ 3/61	16°07'	161°25'					
51-72	2/ 3/61	16°04'	162°18'					
51-73	2/ 3/61	16°51'	162°29'					
51-74	2/ 4/61	17°37'	162°32'					
51-75	2/ 4/61	18°28'	162°32'					
51-76	2/ 4/61	19°48'	162°29'					
51-77	2/ 4/61	20°17'	162°27'					
51-78	2/ 5/61	21°06'	162°27'					
51-79	2/ 5/61	22°02'	162°26'					
51-80	2/ 5/61	22°04'	160°08'					
51-81	2/ 6/61	22°02'	160°02'					
51-82	2/ 7/61	22°06'	160°58'					
51-83	2/ 7/61	22°10'	161°58'					
51-84	2/ 7/61	22°40'	162°30'					
51-85	2/ 7/61	23°34'	162°28'					
51-86	2/ 8/61	23°58'	162°48'					
51-87	2/ 8/61	23°56'	163°47'					
51-88	2/ 8/61	23°56'	164°42'					
51-89	2/ 8/61	23°57'	165°22'					
51-90	2/ 9/61	23°57'	166°05'					
51-91	2/ 9/61	23°45'	167°00'					
51-92	2/10/61	23°00'	167°04'					
51-93	2/10/61	22°32'	167°11'					
51-94	2/10/61	21°45'	167°06'					
51-95	2/10/61	20°57'	167°00'					
51-96	2/11/61	20°06'	166°59'					
51-97	2/11/61	19°40'	166°57'					
51-98	2/11/61	18°25'	167°02'					
51-99	2/11/61	17°36'	167°06'					
51-100	2/12/61	16°46'	167°11'					
51-101	2/12/61	15°58'	167°15'					
51-102	2/12/61	15°58'	168°13'					
51-103	2/13/61	16°30'	169°38'					
51-104	2/15/61	17°01'	169°06'					

CHARLES H. GILBERT CRUISE 51 - Jan. 12 - Feb. 28, 1961--Con.

Bottles (10 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
51-105*	2/15/61	17°55'	169°14'					
51-106	2/15/61	18°46'	169°18'					
51-107	2/15/61	19°27'	169°20'					
51-108	2/16/61	20°08'	169°21'					
51-109	2/16/61	21°08'	169°22'					
51-110	2/16/61	22°01'	169°26'					
51-111	2/16/61	22°49'	169°32'					
51-112	2/17/61	23°28'	169°36'					
51-113	2/17/61	24°01'	169°10'					
51-114	2/17/61	24°02'	168°11'					
51-115	2/17/61	24°02'	167°20'					
51-116	2/18/61	23°58'	166°44'					
51-117	2/19/61	23°56'	166°02'					
51-118	2/19/61	24°02'	165°16'					
51-119	2/20/61	24°02'	164°34'					
51-120	2/20/61	23°08'	164°34'					
51-121	2/20/61	21°42'	164°33'					
51-122	2/20/61	21°15'	164°32'					
51-123	2/21/61	20°21'	164°30'					
51-124	2/21/61	19°57'	164°30'					
51-125	2/21/61	18°38'	164°30'					
51-126	2/21/61	17°44'	164°32'					
51-127	2/22/61	16°46'	164°32'					
51-128	2/22/61	15°58'	164°27'					
51-129	2/22/61	15°58'	163°50'					
51-130	2/22/61	16°00'	163°10'					
51-131	2/23/61	16°06'	162°30'					
51-132	2/23/61	16°12'	161°56'					
51-133	2/23/61	16°12'	161°18'					
51-134	2/23/61	16°10'	160°38'					
51-135	2/24/61	16°07'	159°48'					
51-136	2/24/61	16°19'	159°30'					
51-137	2/24/61	17°19'	159°34'					
51-138	2/24/61	18°17'	159°32'					
51-139	2/25/61	19°13'	159°24'					
51-140	2/25/61	20°11'	159°23'					
51-141	2/25/61	20°59'	159°28'					
51-142	2/25/61	21°10'	159°29'					
51-143	2/25/61	21°17'	159°29'					
51-144	2/25/61	21°27'	159°39'					
51-145	2/25/61	21°34'	159°34'					
51-146	2/25/61	21°39'	159°39'					
51-147	2/25/61	21°50'	159°48'	1	4/ 1/61	21°50'	160°08'	Niihau
51-148	2/26/61	21°58'	159°51'	1	3/ 3/61	22°03'	160°06'	Niihau
51-149	2/26/61	22°06'	159°50'					
51-150	2/26/61	22°14'	159°44'					
51-151	2/26/61	22°21'	159°37'					
51-152	2/26/61	22°29'	159°31'					
51-153	2/26/61	22°38'	159°28'					
51-154	2/26/61	22°46'	159°28'					
51-155	2/26/61	23°28'	159°25'					
51-156	2/26/61	24°01'	159°06'					
51-157	2/26/61	24°05'	158°39'					
51-158	2/27/61	24°11'	158°06'					
51-159	2/27/61	24°04'	157°39'					
51-160	2/27/61	23°53'	157°37'					
51-161	2/27/61	23°44'	157°37'					
51-162	2/27/61	23°29'	157°37'					

*5 bottles released

CHARLES H. GILBERT CRUISE 51 - Jan. 12 - Feb. 28, 1961--Con.

Bottles (10 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
51-163	2/27/61	23°20'	157°36'					
51-164	2/27/61	23°09'	157°35'					
51-165	2/27/61	23°02'	157°34'					
51-166	2/27/61	22°53'	157°34'					
51-167	2/27/61	22°44'	157°34'					
51-168	2/27/61	22°34'	157°33'					
51-169	2/27/61	22°26'	157°32'					
51-170	2/27/61	22°18'	157°32'					
51-171	2/28/61	22°08'	157°31'					
51-172	2/28/61	22°00'	157°31'					
51-173	2/28/61	21°50'	157°30'					
51-174	2/28/61	21°44'	157°30'					
51-175	2/28/61	21°35'	157°32'					
51-176	2/28/61	21°27'	157°35'					
51-177	2/28/61	21°18'	157°38'	1	3/ 4/61	21°17'	157°42'	Oahu
				1	3/ 5/61	21°17'	157°42'	Oahu
51-178	2/28/61	21°15'	157°44'					
51-179	2/28/61	21°15'	157°48'					
51-180	2/28/61	21°17'	157°51'					

CHARLES H. GILBERT CRUISE 52 - March 27 - May 17, 1961

Bottles (10 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
52-1	5/ 4/61	21°11'	157°49'					
52-2	5/ 4/61	21°06'	157°48'					
52-3	5/ 4/61	21°03'	157°47'	1	5/11/61	21°22'	157°42'	Oahu
				2	5/12/61	21°24'	157°45'	Oahu
				1	5/13/61	21°39'	157°56'	Oahu
				1	5/14/61	21°37'	157°55'	Oahu
				1	5/22/61	21°37'	157°55'	Oahu
52-4	5/ 4/61	20°59'	157°45'	1	5/13/61	21°28'	157°48'	Oahu
				1	5/28/61	21°53'	159°28'	Kauai
52-5	5/ 4/61	20°55'	157°45'	1	5/10/61	20°49'	156°49'	Lanai
				1	5/ 7/61	20°48'	157°00'	Lanai
				1	5/10/61	20°52'	156°51'	Lanai
52-6	5/ 4/61	20°51'	157°43'	1	5/10/61	20°52'	156°51'	Lanai
				1	5/29/61	20°58'	156°51'	Lanai
				1	5/14/61	20°51'	157°01'	Lanai
52-7	5/ 4/61	20°49'	157°42'	1	5/22/61	21°35'	157°54'	Oahu
52-8	5/ 4/61	20°45'	157°41'	1	5/17/61	21°06'	156°46'	Molokai
52-9	5/ 4/61	20°40'	157°39'					
52-10	5/ 4/61	20°35'	157°38'					
52-11	5/ 4/61	20°31'	157°36'	1	5/27/61	21°50'	160°03'	Niihau
52-12	5/ 4/61	20°09'	157°34'					
52-13	5/ 5/61	19°45'	157°27'					
52-14	5/ 5/61	19°21'	157°20'					
52-15	5/ 5/61	19°04'	157°33'					
52-16	5/ 5/61	18°38'	157°26'					
52-17	5/ 5/61	18°49'	158°18'					
52-18	5/ 5/61	18°38'	158°41'					
52-19	5/ 5/61	18°26'	159°04'					
52-20	5/ 6/61	18°03'	158°29'					
52-21	5/ 6/61	18°17'	158°14'					
52-22	5/ 6/61	18°34'	157°56'					
52-23	5/ 6/61	18°46'	157°33'					
52-24	5/ 7/61	18°59'	157°01'					
52-25	5/ 7/61	19°15'	156°36'					
52-26	5/ 7/61	19°35'	156°10'					
52-27	5/ 8/61	20°09'	155°57'					

CHARLES H. GILBERT CRUISE 52 - March 27 - May 17, 1961--Con.

Bottles (10 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
52-28	5/ 8/61	20°25'	156°15'	1	5/18/61	21°28'	157°45'	Oahu
52-29	5/ 8/61	20°30'	156°21'	1	5/20/61	21°37'	157°55'	Oahu
52-30	5/ 8/61	20°54'	156°48'	1	5/15/61	20°49'	156°59'	Lanai
				1	5/21/61	20°49'	156°59'	Lanai
				1	9/23/61	20°49'	156°59'	Lanai
				1	11/4/61	20°49'	156°49'	Lanai
				1	5/10/61	20°54'	156°53'	Lanai
				1	5/10/61	20°52'	156°52'	Lanai
52-31	5/ 8/61	20°58'	156°58'					
52-32	5/ 8/61	21°05'	157°18'	1	5/ 9/61	21°24'	157°45'	Oahu
				1	5/13/61	21°39'	157°56'	Oahu
				1	5/14/61	21°35'	157°54'	Oahu
				1	5/30/61	22°09'	159°19'	Kauai
52-33	5/ 8/61	21°00'	157°36'	2	5/10/61	21°22'	157°42'	Oahu
				1	5/13/61	21°17'	157°42'	Oahu
52-34	5/ 8/61	21°14'	157°44'	1	6/18/61	21°53'	159°28'	Kauai
52-35	5/12/61	21°17'	157°51'					
52-36*	5/12/61	21°15'	158°48'					
52-37*	5/12/61	21°14'	157°43'	1	7/ 4/61	21°17'	157°42'	Oahu
				1	5/14/61	21°15'	157°49'	Oahu
52-38*	5/12/61	21°13'	157°38'	1	5/17/61	21°28'	157°50'	Oahu
				1	5/13/61	21°16'	157°43'	Oahu
				1	5/15/61	21°25'	157°48'	Oahu
				1	5/15/61	21°19'	157°39'	Oahu
52-39*	5/12/61	21°12'	157°34'	2	5/15/61	21°24'	157°45'	Oahu
				5	5/14/61	21°24'	157°45'	Oahu
				1	5/13/61	21°24'	157°45'	Oahu
				1	6/ 5/61	21°24'	157°45'	Oahu
				1	5/13/61	21°24'	157°43'	Oahu
				1	5/17/61	21°30'	157°51'	Oahu
52-40*	5/12/61	21°12'	157°26'	1	5/23/61	22°10'	159°19'	Kauai
				1	6/ 3/61	22°03'	159°20'	Kauai
				2	5/17/61	21°34'	157°53'	Oahu
				1	8/13/61	21°55'	159°25'	Kauai
52-41*	5/12/61	21°10'	157°23'					
52-42*	5/12/61	21°07'	157°20'	1	5/21/61	22°04'	159°20'	Kauai
				2	5/27/61	22°03'	159°20'	Kauai
				1	5/26/61	21°55'	159°25'	Kauai
52-43*	5/12/61	21°04'	157°18'	1	5/26/61	21°58'	159°21'	Kauai
				1	5/28/61	22°03'	159°20'	Kauai
				1	6/ 2/61	22°13'	159°23'	Kauai
				1	6/ 1/61	21°59'	159°20'	Kauai
52-44*	5/12/61	21°00'	157°15'	1	5/30/61	21°43'	157°59'	Oahu
52-45*	5/12/61	20°58'	157°12'	1	5/27/61	22°09'	159°19'	Kauai
				1	5/15/61	21°43'	157°59'	Oahu
				1	6/ 2/61	21°43'	157°59'	Oahu
52-46*	5/17/61	21°16'	157°50'	1	6/21/61	21°43'	157°59'	Oahu
				1	6/30/61	21°24'	157°45'	Oahu
52-47*	5/17/61	21°14'	157°42'	1	6/ 3/61	21°22'	157°42'	Oahu
52-48*	5/17/61	21°19'	157°38'	1	5/18/61	21°19'	157°39'	Oahu
				1	5/19/61	21°24'	157°43'	Oahu
				1	6/29/61	21°19'	157°39'	Oahu
				2	5/18/61	21°20'	157°42'	Oahu
				1	5/17/61	21°20'	157°42'	Oahu
52-49*	5/17/61	21°24'	157°40'	1	5/18/61	21°24'	157°45'	Oahu
				14	5/18/61	21°24'	157°43'	Oahu
				1	5/20/61	21°24'	157°43'	Oahu
52-50*	5/17/61	21°28'	157°42'	1	5/19/61	21°28'	157°50'	Oahu
				1	5/21/61	21°28'	157°50'	Oahu
				2	5/19/61	21°28'	157°50'	Oahu
				2	5/20/61	21°28'	157°50'	Oahu

* 20 bottles per batch.

CHARLES H. GILBERT CRUISE 52 - March 27 - May 17, 1961--Con.

Bottles (10 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
				1	5/24/61	21°25'	157°48'	Oahu
				1	7/19/61	21°28'	157°51'	Oahu
52-51*	5/17/61	21°34'	157°48'	1	5/25/61	21°24'	157°45'	Oahu
				1	5/19/61	21°37'	157°55'	Oahu
				1	5/20/61	21°43'	157°59'	Oahu
52-52*	5/17/61	21°42'	157°55'	3	5/25/61	21°43'	157°49'	Oahu
				2	5/27/61	21°24'	157°45'	Oahu
				2	5/28/61	21°24'	157°45'	Oahu
52-53*	5/17/61	21°43'	158°02'					
52-54**	5/17/61	21°39'	158°12'	1	6/13/61	22°05'	159°19'	Kauai
				1	7/ 3/61	22°03'	159°20'	Kauai
52-55*	5/17/61	21°35'	159°19'					
52-56***	5/17/61	21°27'	158°15'	1	6/ 9/61	21°35'	158°17'	Oahu
				1	8/ 1/62	21°05'	157°02'	Molokai
52-57***	5/17/61	21°20'	158°10'					
52-58***	5/17/61	21°17'	158°02'	1	5/18/61	21°18'	158°07'	Oahu
				1	7/15/61	22°03'	159°20'	Kauai
52-59***	5/17/61	21°17'	157°53'					

*20 bottles per batch.
**17 bottles per batch.
***40 bottles per batch.

CHARLES H. GILBERT CRUISE 53 - June 20 to July 30, 1961

Bottles (10 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
53-1	6/23/61	21°20'	157°53'					
53-2	6/23/61	21°13'	157°47'					
53-3	6/23/61	21°08'	157°41'					
53-4	6/23/61	21°04'	157°35'	4	6/27/61	21°17'	157°42'	Oahu
				1	6/28/61	21°17'	157°42'	Oahu
				1	6/27/61	21°19'	157°39'	Oahu
				1	6/27/61	21°24'	157°43'	Oahu
				1	6/29/61	21°19'	157°39'	Oahu
53-5	6/23/61	21°01'	157°29'	1	6/26/61	21°22'	157°42'	Oahu
				2	6/27/61	21°17'	157°42'	Oahu
				1	6/28/61	21°17'	157°42'	Oahu
				1	6/29/61	21°19'	157°39'	Oahu
53-6	6/23/61	20°57'	157°23'					
53-7	6/23/61	20°40'	157°02'					
53-8	6/23/61	20°26'	156°21'					
53-9	6/24/61	19°56'	156°27'					
53-10	6/24/61	19°32'	156°06'					
53-11	6/24/61	19°24'	156°04'					
53-12	6/24/61	19°21'	156°03'					
53-13	6/24/61	19°17'	156°02'					
53-14	6/24/61	19°13'	156°02'					
53-15	6/24/61	19°05'	156°00'					
53-16	6/24/61	18°49'	155°51'					
53-17	6/24/61	18°30'	155°41'					
53-18	6/24/61	18°11'	155°32'					
53-19	6/24/61	17°52'	155°20'					
53-20	6/25/61	17°35'	155°07'					
53-21	6/25/61	17°17'	154°54'					
53-22	6/25/61	16°59'	154°42'					
53-23	6/25/61	16°39'	154°27'					
53-24	6/25/61	16°04'	153°59'					
53-25	6/25/61	16°02'	153°38'					

CHARLES H. GILBERT CRUISE 53 - June 20 to July 30, 1961--Con.

Bottles (10 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
53-26	6/26/61	16°06'	152°56'					
53-27	6/26/61	16°11'	152°10'					
53-28	6/26/61	16°30'	151°38'					
53-29	6/26/61	17°16'	151°38'					
53-30	6/27/61	18°07'	151°37'					
53-31	6/27/61	18°58'	151°36'					
53-32	6/27/61	19°46'	151°35'					
53-33	6/28/61	21°22'	151°33'					
53-34	6/28/61	22°12'	151°32'					
53-35	6/28/61	23°00'	152°32'					
53-36	6/29/61	23°50'	153°51'					
53-37	6/29/61	23°21'	154°05'					
53-38	6/29/61	22°23'	154°05'					
53-39	6/30/61	21°43'	154°02'	1	8/ 9/61	21°43'	157°59'	Oahu
				1	8/ 8/61	21°39'	157°56'	Oahu
53-40	6/30/61	21°17'	154°02'	1	8/ 4/61	21°39'	157°56'	Oahu
53-41	6/30/61	20°46'	154°01'					
53-42	6/30/61	20°15'	154°01'	1	8/10/61	21°35'	157°54'	Oahu
53-43	6/30/61	19°43'	154°00'	1	7/29/61	21°24'	157°45'	Oahu
				1	7/27/61	21°39'	157°56'	Oahu
53-44	6/30/61	19°16'	154°00'					
53-45	6/30/61	18°50'	154°00'					
53-46	6/30/61	18°25'	154°00'					
53-47	7/ 1/61	18°00'	154°00'					
53-48	7/ 1/61	17°33'	154°16'					
53-49	7/ 1/61	17°07'	154°32'					
53-50	7/ 1/61	16°40'	154°48'					
53-51	7/ 1/61	16°21'	155°00'					
53-52	7/ 1/61	16°12'	155°25'					
53-53	7/ 1/61	16°14'	155°56'					
53-54	7/ 1/61	16°17'	156°22'					
53-55	7/ 2/61	16°19'	156°54'					
53-56	7/ 2/61	16°43'	157°06'					
53-57	7/ 2/61	17°12'	157°11'					
53-58	7/ 2/61	17°42'	157°17'					
53-59	7/ 2/61	18°03'	157°21'					
53-60	7/ 2/61	18°32'	157°26'					
53-61	7/ 2/61	19°00'	157°31'					
53-62	7/ 3/61	19°59'	157°39'					
53-63	7/ 3/61	20°23'	157°43'	1	7/13/61	20°54'	156°53'	Lanai
				1	9/17/61	20°54'	156°53'	Lanai
53-64	7/ 3/61	20°31'	157°45'					
53-65	7/ 3/61	20°39'	157°46'					
53-66	7/ 3/61	20°47'	157°48'					
53-67	7/ 3/61	20°55'	157°48'					
53-68	7/ 3/61	21°03'	157°50'					
53-69	7/ 7/61	21°15'	157°57'					
53-70	7/ 7/61	21°09'	157°59'					
53-71	7/ 7/61	21°01'	158°02'					
53-72	7/ 7/61	20°52'	158°05'					
53-73	7/ 7/61	20°35'	158°10'					
53-74	7/ 7/61	20°27'	158°13'					
53-75	7/ 8/61	20°02'	158°27'					
53-76	7/ 8/63	19°11'	158°38'					
53-77	7/ 8/61	18°45'	158°46'					
53-78	7/ 8/61	18°28'	158°53'					
53-79	7/ 8/61	17°40'	159°10'					
53-80	7/ 9/61	16°57'	159°26'					
53-81	7/ 9/61	16°10'	159°37'					
53-82	7/ 9/61	16°05'	160°20'					
53-83	7/ 9/61	16°07'	161°18'					
53-84	7/10/61	16°00'	162°18'					
53-85	7/10/61	15°54'	163°11'					

CHARLES H. GILBERT CRUISE 53 - June 20 to July 30, 1961--Con.

Bottles (10 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
53-86	7/10/61	15°59'	164°00'					
53-87	7/10/61	16°23'	164°32'					
53-88	7/11/61	17°19'	164°36'					
53-89	7/11/61	18°13'	164°41'					
53-90	7/11/61	19°06'	164°43'					
53-91	7/11/61	19°58'	164°49'					
53-92	7/12/61	20°55'	164°48'					
53-93	7/12/61	21°41'	164°40'					
53-94	7/12/61	22°29'	164°36'					
53-95	7/12/61	23°17'	164°36'					
53-96	7/13/61	24°02'	164°44'					
53-97	7/13/61	24°09'	165°49'					
53-98	7/14/61	23°53'	166°58'					
53-99	7/14/61	23°56'	167°50'					
53-100	7/15/61	23°55'	168°57'					
53-101	7/15/61	23°28'	169°21'					
53-102	7/15/61	22°35'	169°25'					
53-103	7/15/61	21°42'	169°28'					
53-104	7/16/61	20°58'	169°32'					
53-105	7/16/61	20°27'	169°38'					
53-106	7/16/61	19°21'	169°40'					
53-107	7/16/61	18°32'	169°35'					
53-108	7/17/61	17°46'	169°31'					
53-109	7/19/61	16°18'	169°32'					
53-110	7/19/61	16°02'	169°25'					
53-111	7/20/61	16°03'	168°41'					
53-112	7/20/61	16°03'	167°52'					
53-113	7/20/61	16°02'	167°06'					
53-114	7/20/61	16°53'	167°09'					
53-115	7/21/61	17°46'	167°11'					
53-116	7/21/61	18°35'	167°09'					
53-117	7/21/61	19°23'	167°07'					
53-118	7/21/61	20°16'	167°06'	1	9/ 7/61	26°04'	173°58'	Lisianski Island.
53-119	7/22/61	21°07'	167°08'					
53-120	7/22/61	22°01'	167°08'					
53-121	7/22/61	22°51'	167°02'					
53-122	7/22/61	23°19'	166°11'					
53-123	7/23/61	23°42'	165°24'					
53-124	7/23/61	23°58'	164°38'					
53-125	7/23/61	24°01'	163°42'					
53-126	7/23/61	24°04'	162°50'					
53-127	7/24/61	23°55'	162°02'					
53-128	7/24/61	22°59'	162°05'					
53-129	7/24/61	22°12'	162°08'					
53-130	7/24/61	21°20'	162°13'					
53-131	7/25/61	20°25'	162°15'					
53-132	7/25/61	19°32'	162°09'					
53-133	7/25/61	18°40'	162°06'					
53-134	7/25/61	17°39'	161°57'					
53-135	7/26/61	17°00'	161°39'					
53-136	7/26/61	16°59'	160°00'					
53-137	7/26/61	17°57'	160°00'					
53-138	7/27/61	18°57'	159°59'					
53-139	7/27/61	19°49'	159°56'					
53-140	7/27/61	20°42'	159°53'					
53-141	7/27/61	21°25'	159°54'					
53-142	7/27/61	21°29'	159°54'					
53-143	7/27/61	21°41'	159°55'					
53-144	7/27/61	21°51'	159°55'					
53-145	7/27/61	21°58'	159°54'					
53-146	7/27/61	22°06'	159°55'					
53-147	7/28/61	22°15'	159°55'					

CHARLES H. GILBERT CRUISE 53 - June 20 to July 30, 1961--Con.

Bottles (10 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
53-148	7/28/61	22°15'	159°53'					
53-149	7/28/61	22°15'	159°50'					
53-150	7/28/61	22°24'	159°50'					
53-151	7/28/61	22°34'	159°50'					
53-152	7/28/61	22°43'	159°49'					
53-153	7/28/61	22°52'	159°49'					
53-154	7/28/61	23°01'	159°49'					
53-155	7/28/61	23°10'	159°49'					
53-156	7/28/61	23°38'	159°44'					
53-157	7/28/61	24°01'	159°37'					
53-158	7/28/61	24°03'	159°05'					
53-159	7/28/61	24°05'	158°35'					
53-160	7/28/61	24°06'	158°09'					
53-161	7/29/61	24°04'	157°43'					
53-162	7/29/61	24°02'	156°57'					
53-163	7/29/61	23°40'	157°06'					
53-164	7/29/61	23°32'	157°13'					
53-165*	7/29/61	23°25'	157°17'					
53-166	7/29/61	23°19'	157°20'					
53-167	7/29/61	23°12'	157°24'					
53-168	7/29/61	23°05'	157°28'					
53-169	7/29/61	22°58'	157°31'					
53-170	7/29/61	22°51'	157°33'					
53-171	7/29/61	22°45'	157°37'					
53-172	7/29/61	22°38'	157°40'					
53-173	7/29/61	22°30'	157°40'	2	8/14/61	22°03'	159°20'	Kauai
				1	8/23/61	22°05'	159°19'	Kauai
				1	8/13/61	22°05'	159°19'	Kauai
				1	8/12/61	22°14'	159°24'	Kauai
				1	8/15/61	22°11'	159°18'	Kauai
53-174	7/29/61	22°23'	157°40'					
53-175	7/30/61	22°14'	157°40'					
53-176	7/30/61	22°06'	157°40'					
53-177	7/30/61	21°59'	157°40'					
53-178	7/30/61	21°50'	157°39'	1	8/18/61	21°33'	157°51'	Oahu
				1	8/ 4/61	21°31'	157°50'	Oahu
				1	8/ 6/61	21°28'	157°48'	Oahu
				1	8/ 4/61	21°34'	157°53'	Oahu
53-179	7/30/61	21°42'	157°38'	1	8/ 4/61	21°35'	157°54'	Oahu
				1	8/ 8/61	21°29'	157°51'	Oahu
				1	8/ 2/61	21°37'	157°55'	Oahu
53-180	7/30/61	21°33'	157°36'	6	8/ 2/61	21°37'	157°55'	Oahu
				2	8/ 2/61	21°39'	157°56'	Oahu
				1	8/ 2/61	21°25'	157°44'	Oahu
53-181	7/30/61	21°25'	157°37'	1	7/30/61	21°24'	157°45'	Oahu
				14	7/31/61	21°24'	157°45'	Oahu
53-182	7/30/61	21°18'	157°38'	2	8/ 5/61	21°19'	157°39'	Oahu
				1	8/15/61	21°19'	157°39'	Oahu
				1	8/ 6/61	21°19'	157°39'	Oahu
				1	7/30/61	21°19'	157°39'	Oahu
				1	8/18/61	21°19'	157°39'	Oahu

* 20 bottles in lots from 53-165 to 182 inclusive.

M/V BROADBILL CRUISE 1 - Sept. 23 - Sept 27, 1961

Bottles (10 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
Br-1	9/23/61	21°12'	157°49'					
Br-2	9/23/61	21°02'	157°47'					
Br-3	9/23/61	20°52'	157°45'					
Br-4	9/23/61	20°52'	157°48'					
Br-5	9/23/61	21°04'	157°50'					
Br-6	9/27/61	21°19'	158°12'					
Br-7	9/27/61	21°23'	158°25'					

CHARLES H. GILBERT CRUISE 54 - September 29 - December 4, 1961

Bottles (10 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
54-1	9/29/61	21°09'	157°42'	1	10/ 9/61	21°24'	157°45'	Oahu
				1	10/12/61	21°24'	157°45'	Oahu
				1	10/11/61	21°28'	157°48'	Oahu
				1	10/10/61	21°28'	157°48'	Oahu
54-2	9/29/61	21°00'	157°44'	1	10/ 5/61	21°35'	157°54'	Oahu
54-3	9/29/61	20°50'	157°41'					
54-4	9/29/61	20°42'	157°37'					
54-5	9/29/61	20°34'	157°34'					
54-6	9/29/61	20°24'	157°28'					
54-7	9/30/61	20°00'	157°17'					
54-8	9/30/61	19°36'	157°07'					
54-9	9/30/61	19°10'	156°33'					
54-10	9/30/61	18°40'	156°46'					
54-11	9/30/61	18°26'	156°31'					
54-12	9/30/61	17°58'	156°53'					
54-13	9/30/61	17°35'	156°15'					
54-14	9/30/61	17°11'	156°05'					
54-15	10/ 1/61	16°47'	155°53'					
54-16	10/ 1/61	16°22'	155°40'					
54-17	10/ 1/61	15°34'	155°16'					
54-18	10/ 1/61	15°11'	155°04'					
54-19	10/ 1/61	14°46'	154°29'					
54-20	10/ 1/61	14°22'	154°37'					
54-21*	10/ 1/61	14°09'	154°32'					
54-22*	10/ 2/61	12°38'	154°34'					
54-23*	10/ 2/61	11°05'	152°36'					
54-24*	10/ 3/61	10°00'	151°21'					
54-25**	10/ 3/61	09°30'	151°04'					
54-26*	10/ 4/61	09°04'	150°27'					
54-27*	10/ 4/61	07°05'	149°17'					
54-28*	10/ 5/61	06°16'	148°07'					
54-29*	10/ 5/61	04°35'	147°02'					
54-30*	10/ 6/61	02°57'	146°11'					
54-31*	10/ 6/61	01°22'	145°21'					
54-32*	10/ 7/61	00°02'	144°32'					
54-33*	10/ 7/61	01°25'S	143°18'					
54-34***	10/ 8/61	02°57'S	143°03'					
54-35*	12/ 2/61	13°23'	157°45'					
54-36	12/ 2/61	14°17'	157°51'					
54-37	12/ 2/61	15°12'	157°54'					
54-38	12/ 2/61	15°40'	157°55'					
54-39	12/ 3/61	16°08'	157°55'					
54-40	12/ 3/61	16°35'	157°54'					

*40 per lot.
**37 bottles released in lot.
***20 bottles in lot.

CHARLES H. GILBERT CRUISE 54 - September 29 - December 4, 1961--Con.

Bottles (10 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
54-41	12/ 3/61	17°06'	157°53'					
54-42	12/ 3/61	17°31'	157°55'					
54-43	12/ 3/61	17°59'	157°55'					
54-44	12/ 3/61	18°25'	157°55'					
54-45	12/ 3/61	18°55'	157°54'					
54-46	12/ 3/61	19°27'	157°50'					
54-47	12/ 4/61	19°36'	157°49'					
54-48	12/ 4/61	20°25'	157°51'					
54-49	12/ 4/61	20°35'	157°51'					
54-50	12/ 4/61	20°45'	157°52'					
54-51	12/ 4/61	20°51'	157°52'					
54-52	12/ 4/61	20°58'	157°50'					
54-53	12/ 4/61	21°04'	157°50'	2	12/26/61	22°03'	159°20'	Kauai
				1	1/ 1/62	22°03'	159°20'	Kauai
				1	12/28/61	21°58'	159°21'	Kauai
				1	1/ 7/62	22°03'	159°20'	Kauai
				2	12/27/61	22°00'	159°21'	Kauai

CHARLES H. GILBERT CRUISE 55 - January 15 - April 3, 1962

Bottles (10 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
55-1	1/15/62	21°13'	157°56'					
55-2	1/15/62	21°05'	158°02'	1	1/18/62	21°17'	157°45'	Oahu
				4	1/18/62	21°18'	157°42'	Oahu
				1	1/24/62	21°16'	157°41'	Oahu
55-3	1/15/62	21°00'	158°09'	1	1/24/62	21°24'	157°45'	Oahu
55-4	1/15/62	20°54'	158°16'					
55-5	1/15/62	20°48'	158°23'					
55-6	1/15/62	20°42'	158°31'					
55-7	1/15/62	20°29'	158°46'					
55-8	1/16/62	20°10'	159°09'					
55-9	1/16/62	19°51'	159°32'					
55-10	1/16/62	19°31'	159°55'					
55-11	1/16/62	19°11'	160°20'					
55-12	1/16/62	18°55'	160°43'					
55-13	1/16/62	18°35'	161°09'					
55-14	1/16/62	18°16'	161°33'					
55-15	1/16/62	18°09'	161°51'					
55-16	1/17/62	17°52'	162°02'					
55-17	1/17/62	17°32'	162°24'					
55-18	1/17/62	17°12'	162°46'					
55-19	1/17/62	16°56'	163°05'					
55-20	1/17/62	16°38'	163°27'					
55-21	1/17/62	16°18'	163°48'					
55-22	1/17/63	15°58'	164°10'					
55-23	1/18/62	15°33'	164°38'					
55-24	1/18/62	15°17'	165°00'					
55-25	1/18/62	15°06'	165°15'					
55-26*	1/18/62	13°55'	166°55'					
55-27*	1/19/62	12°52'	168°01'					
55-28	1/19/62	12°22'	168°42'					
55-29*	1/19/62	11°47'	169°19'					
55-30*	1/20/62	10°36'	170°21'					
55-31*	1/20/62	09°21'	171°41'					
55-32*	1/21/62	08°16'	173°01'					
55-33*	1/21/62	07°10'	174°20'					

* 40 bottles per batch.

CHARLES H. GILBERT CRUISE 55 - January 15 - April 3, 1962--Con.

Bottles (10 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
55-34*	1/22/62	06°18'	175°33'	1	8/18/62	07°31'	152°05'E	Onari Island
				1	4/ 6/62	07°10'	171°13'E	Ine Village, Arno Atoll
55-35*	1/22/62	05°12'	176°56'					
55-36*	1/23/62	04°06'	178°12'					
55-37*	1/23/62	02°52'	179°34'	1	4/11/62	05°19'	162°59'E	Tafunsak, Kusaie, E. Caroline Is.
				1	2/ 7/62	03°08'	172°54'E	Makin Atoll, Gilberts
55-38*	1/25/62	01°33'	179°01'E	1	4/21/62	01°24'S	138°45'E	St. Mathias, New Guinea
				1	6/ 2/62	07°25'	151°47'E	Epitar, Caroline Is.
55-39*	1/25/62	00°14'	177°44'E	11	2/ 2/62	00°55'	173°00'E	Maiana Is., Gilberts
				1	2/ 7/62	00°55'	173°00'E	Maiana Is., Gilberts
				1	2/28/62	00°55'	173°00'E.	Maiana Is., Gilberts
55-40*	1/26/62	00°56'S	176°22'E	1	10/10/62	07°47'S	156°22'E	Vella Lavella
				1	3/24/62	05°00'S	155°20'E	Green Island, New Guinea
				1	4/22/62	02°04'S	147°00'E	Nihau Is., Manus, New Guinea
				1	9/13/62	10°28'S	150°30'E	Finschhafen, New Guinea
55-41*	1/26/62	02°25'S	175°11'E	1	3/25/62	05°10'S	154°30'E	Bougainville, New Guinea
55-42*	1/27/62	03°27'S	173°10'E	1	9/22/62	11°25'S	152°00'E	Conflict Group Papua
				1	6/23/62	10°49'S	165°57'E	Nambalue, Santa Cruz Is.
55-43*	1/27/62	04°57'S	172°35'E	1	5/ 4/62	08°21'S	162°40'E	Sikaiana Is., Solomon Is.
55-44*	3/25/62	04°21'S	161°03'					
55-45*	3/25/62	03°53'S	160°39'					
55-46*	3/26/62	02°44'S	159°34'	1	6/24/63	01°43'S	142°54'E	Wuvulu Is.
55-47*	3/26/62	01°43'S	158°43'					
55-48*	3/27/62	00°25'	157°12'					
55-49*	3/28/62	01°06'	157°04'					
55-50*	3/29/62	03°06'	157°13'					
55-51*	3/30/62	05°40'	157°05'					
55-52*	3/30/62	07°20'	157°03'					
55-53*	3/31/62	09°05'	157°00'					
55-54*	3/31/62	10°50'	156°58'					
55-55*	4/ 1/62	12°35'	156°58'					
55-56*	4/ 1/62	14°29'	156°57'					
55-57	4/ 2/62	15°22'	157°03'					
55-58	4/ 2/62	15°47'	157°06'					
55-59	4/ 2/62	16°13'	157°09'					
55-60	4/ 2/62	16°39'	157°11'					
55-61	4/ 2/62	17°07'	157°15'					
55-62	4/ 2/62	17°36'	157°17'					
55-63	4/ 2/62	18°04'	157°22'					
55-64	4/ 2/62	18°32'	157°25'					
55-65	4/ 3/62	18°59'	157°31'					
55-66	4/ 3/62	19°26'	157°33'					
55-67	4/ 3/62	19°53'	157°38'					
55-68	4/ 3/62	20°02'	157°39'					
55-69	4/ 3/62	20°16'	157°41'					

* 40 bottles per batch.

CHARLES H. GILBERT CRUISE 55 - January 15 - April 3, 1962--Con.

Bottles (10 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
55-70	4/ 3/62	20°19'	157°42'					
55-71	4/ 3/62	20°28'	157°44'					
55-72	4/ 3/62	20°38'	157°44'					
55-73	4/ 3/62	20°48'	157°44'	3	4/12/62	21°24'	157°43'	Oahu
55-74	4/ 3/62	20°58'	157°46'					
55-75	4/ 3/62	21°08'	157°49'	1	6/14/62	22°03'	159°20'	Kauai

CHARLES H. GILBERT CRUISE 56 - April 24 - May 12, 1962

Bottles (20 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
56-1	4/24/62	21°10'	157°51'	5	4/26/62	21°17'	157°45'	Oahu
				1	6/ 5/62	21°17'	157°45'	Oahu
				1	4/26/62	21°16'	157°47'	Oahu
				1	5/30/62	22°05'	159°19'	Kauai
				1	4/25/62	21°18'	157°42'	Oahu
				1	4/26/62	21°18'	157°42'	Oahu
				1	5/ 3/62	21°17'	157°45'	Oahu
56-2	4/24/62	21°03'	157°51'	1	5/12/62	21°24'	157°45'	Oahu
				1	6/30/62	20°49'	156°59'	Lanai
				1	8/ 4/62	21°35'	158°17'	Oahu
56-3	4/24/62	20°55'	157°50'					
56-4	4/24/62	20°48'	157°50'	1	5/13/62	21°24'	157°45'	Oahu
				1	5/14/62	21°24'	157°45'	Oahu
56-5	4/24/62	20°41'	157°49'					
56-6	4/24/62	20°33'	157°49'					
56-7	4/25/62	20°10'	157°48'	1	5/13/62	20°03'	155°51'	Hawaii
				1	5/27/62	21°28'	157°48'	Oahu
56-8	4/25/62	19°50'	157°47'	1	5/27/62	19°34'	153°58'	Hawaii
56-9	4/25/62	19°29'	157°46'	1	5/19/62	20°53'	156°41'	Maui
				1	5/18/62	19°59'	155°50'	Hawaii
56-10	4/25/62	19°09'	157°45'					
56-11	4/25/62	18°47'	157°45'					
56-12	4/25/62	18°19'	157°47'					
56-13	4/25/62	17°53'	157°48'					
56-14	4/25/62	17°25'	157°50'					
56-15	4/26/62	17°01'	157°50'					
56-16	4/26/62	16°36'	157°50'					
56-17	4/26/62	16°11'	157°50'					
56-18	4/26/62	15°43'	157°51'					
56-19	4/26/62	15°17'	157°52'					
56-20	4/26/62	14°49'	157°53'					
56-21	5/11/62	16°01'	158°09'					
56-22	5/11/62	16°31'	158°14'					

CHARLES H. GILBERT CRUISE 57 - June 4 - June 25, 1962

Bottles (20 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
57-1	6/ 4/62	21°07'	157°58'					
57-2	6/ 4/62	20°57'	157°58'					
57-3	6/ 4/62	20°42'	157°58'					
57-4	6/ 4/62	20°34'	157°58'					
57-5	6/ 4/62	20°26'	157°58'					
57-6	6/ 4/62	20°18'	157°58'					
57-7	6/ 4/62	20°03'	157°56'					
57-8	6/ 5/62	19°37'	157°57'	1	6/23/62	21°10'	156°43'	Molokai
	6/ 5/62	19°37'	157°57'	1	6/22/62	20°53'	156°41'	Maui
	6/ 5/62	19°37'	157°57'	1	6/27/62	20°49'	156°59'	Lanai
57-9	6/ 5/62	19°12'	157°56'					
57-10	6/ 5/62	18°48'	157°56'					
57-11	6/ 5/62	18°30'	157°55'					
57-12	6/ 5/62	18°07'	157°54'					
57-13	6/ 5/62	17°43'	157°52'					
57-14	6/ 5/62	17°20'	157°50'					
57-15	6/ 5/62	16°56'	157°48'					
57-16	6/ 6/62	16°25'	157°45'					
57-17	6/ 6/62	16°04'	157°43'					
57-18	6/ 6/62	15°37'	157°41'					
57-19	6/ 6/62	15°14'	157°39'					
Following lots consist of 40 drift bottles and 40 drift cards								
57-20*	6/25/62	19°29'	157°57'					
57-21	6/25/62	19°39'	157°56'					
57-22	6/25/62	19°49'	157°56'					
57-23	6/25/62	19°59'	157°55'					
57-24	6/25/62	20°08'	157°55'					
57-25	6/25/62	20°18'	157°54'	1	8/1/62	21°58'	159°43'	Kauai
57-26	6/25/62	20°28'	157°53'					
57-27	6/25/62	20°36'	157°52'					
57-28	6/25/62	20°54'	157°53'					
57-29	6/25/62	21°03'	157°54'					

* 40 bottles and 30 cards released.

CHARLES H. GILBERT CRUISE 58 - July 10 - July 19, 1962

Cards & bottles (100 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
58-1*	7/10/62	21°21'	157°40'	1	7/13/62	21°19'	157°39'	Oahu
	7/10/62	21°21'	157°40'	6	7/11/62	21°19'	157°39'	
	7/10/62	21°21'	157°40'	23	7/11/62	21°20'	157°42'	Oahu
	7/10/62	21°21'	157°40'	4	7/13/62	21°20'	157°42'	
	7/10/62	21°21'	157°40'	4	7/12/62	21°21'	157°42'	
	7/10/62	21°21'	157°40'	3	7/15/62	21°20'	157°42'	
	7/10/62	21°21'	157°40'	2	7/14/62	21°20'	157°42'	
	7/10/62	21°21'	157°40'	1	7/22/62	21°20'	157°42'	
	7/10/62	21°21'	157°40'	1	7/16/62	21°22'	157°42'	Oahu
	7/10/62	21°21'	157°40'	1	7/11/62	21°22'	157°42'	
58-2*	7/10/62	21°26'	157°42'	1	7/11/62	21°24'	157°43'	Oahu
	7/10/62	21°26'	157°42'	1	7/10/62	21°24'	157°45'	Oahu
	7/10/62	21°26'	157°42'	71	7/11/62	21°24'	157°45'	
	7/10/62	21°26'	157°42'	7	7/12/62	21°24'	157°45'	

* 100 cards and 100 bottles.

CHARLES H. GILBERT CRUISE 58 - July 10 - July 19, 1962--Con.

Cards & bottles (100 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
58-3**	7/10/62	21°32'	157°48'	1	7/16/62	21°43'	157°59'	Oahu
	7/10/62	21°32'	157°48'	1	7/12/62	21°35'	157°54'	Oahu
	7/10/62	21°32'	157°48'	1	8/ 4/62	21°39'	157°56'	Oahu
	7/10/62	21°32'	157°48'	38	7/11/62	21°39'	157°56'	
	7/10/62	21°32'	157°48'	26	7/12/62	21°39'	157°56'	
	7/10/62	21°32'	157°48'	38	7/11/62	21°37'	157°55'	Oahu
	7/10/62	21°32'	157°48'	4	7/12/62	21°37'	157°55'	
	7/10/62	21°32'	157°48'	5	7/13/62	21°37'	157°55'	
	7/10/62	21°32'	157°48'	1	7/15/62	21°37'	157°55'	
58-4***	7/10/62	21°40'	157°53'	1	3/6/63	27°55'	174°44'	Pearl & Hermes Reef
	7/10/62	21°40'	157°53'	1	7/11/62	21°39'	157°56'	Oahu
	7/10/62	21°40'	157°53'	1	7/14/62	21°36'	158°06'	Oahu
	7/10/62	21°40'	157°53'	1	7/21/62	21°43'	157°59'	Oahu
	7/10/62	21°40'	157°53'	1	7/16/62	21°43'	157°59'	Oahu
	7/10/62	21°40'	157°53'	1	7/18/62	21°43'	157°59'	
	7/10/62	21°40'	157°53'	1	7/22/62	21°43'	157°59'	

**100 cards and 120 bottles.
***100 cards and 160 bottles.

CHARLES H. GILBERT CRUISE 59 - July 23 - August 15, 1962

Cards (20 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
59-1	7/23/62	21°08'	157°52'					
59-2	7/23/62	20°58'	157°53'					
59-3	7/23/62	20°39'	157°53'					
59-4	7/23/62	20°38'	157°55'					
59-5	7/23/62	20°31'	157°54'					
59-6	7/23/62	20°22'	157°53'					
59-7	7/23/62	19°57'	157°52'					
59-8	7/23/62	19°28'	157°53'					
59-9	7/24/62	18°59'	157°52'					
59-10	7/24/62	18°29'	157°49'					
59-11	7/24/62	18°03'	157°48'					
59-12	7/24/62	17°36'	157°48'					
59-13	7/24/62	17°11'	157°49'					
59-14	7/24/62	16°45'	157°49'					
59-15	7/24/62	16°19'	157°48'					
59-16	7/24/62	16°00'	151°47'					
59-17	7/24/62	15°34'	157°48'					
59-18	7/24/62	15°07'	157°49'					
59-19	8/15/62	20°41'	158°02'					
59-20	8/15/62	20°50'	157°59'					
59-21	8/15/62	21°02'	157°56'					
59-22	8/15/62	21°08'	157°53'					

CHARLES H. GILBERT CRUISE 60 - September 26 - October 12, 1962

Cards & bottles (10 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
60-1	9/29/62	19°29'	155°59'					
60-2	9/30/62	19°30'	156°02'					
60-3	9/30/62	19°28'	156°02'					
60-4	9/30/62	19°29'	156°01'					
60-5	9/30/62	19°31'	156°00'					
60-6	10/ 1/62	19°35'	156°00'					
60-7	10/ 1/62	19°38'	156°02'					
60-8	10/ 1/62	19°44'	156°06'					
60-9	10/ 1/62	19°47'	156°05'					
60-10	10/ 3/62	19°33'	156°00'					
60-11	10/ 3/62	19°33'	156°00'					
60-12	10/ 4/62	19°34'	156°01'					
60-13	10/ 4/62	19°28'	156°02'					
60-14	10/ 5/62	19°14'	156°05'					
60-15	10/ 5/62	19°07'	156°04'					
60-16	10/ 5/62	19°11'	155°59'					
60-17*	10/ 5/62	19°15'	155°57'					
60-18	10/ 6/62	19°07'	156°04'					
60-19	10/ 7/62	19°20'	155°57'					
60-20	10/ 7/62	19°25'	156°00'					
60-21	10/ 7/62	19°38'	156°04'					
60-22	10/ 9/62	19°04'	156°03'					
60-23	10/ 9/62	19°05'	155°57'					
60-24	10/10/62	19°04'	155°56'					
60-25	10/10/62	19°05'	155°56'					
60-26	10/10/62	19°04'	155°57'					
60-27	10/11/62	19°02'	155°59'					
60-28	10/11/62	19°06'	156°02'					

* 20 cards released.

CHARLES H. GILBERT CRUISE 63 - January 10 - March 2, 1963

Cards & bottles (20 ea. per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
63-1*	1/10/63	21°17'	157°52'					
63-2	1/10/63	21°06'	157°42'	1	3/22/63	21°22'	157°42'	Oahu(Bellows)
				1	1/26/63	21°19'	157°53'	Oahu(Ft.Kam)
				1	2/13/63	21°06'	157°10'	Molokai
				1	3/ 3/63	21°06'	157°14'	Molokai
63-3	1/10/63	20°59'	157°37'					
63-4	1/10/63	20°52'	157°30'	1	2/ 9/63	20°49'	156°59'	Lanai
63-5	1/10/63	20°44'	157°24'					
63-6	1/10/63	20°38'	157°19'					
63-7**	1/11/63	19°05'	155°59'					
63-8	1/11/63	18°58'	155°52'					
63-9	1/11/63	18°35'	155°18'					
63-10	1/11/63	18°00'	154°30'					
63-11	1/12/63	17°24'	153°36'					
63-12	1/12/63	16°54'	151°54'					
63-13	1/12/63	15°48'	151°18'					
63-14	1/13/63	15°18'	150°30'					
63-15	1/14/63	20°47'	149°50'					
63-16	1/15/63	20°49'	150°02'					
63-17	1/17/63	18°04'	149°46'					

* Releases 63-1 through 63-6 = 20 cards and 20 bottles each.
** Releases 63-7 through 63-28 = 20 cards.

CHARLES H. GILBERT CRUISE 63 - January 10 - March 2, 1963--Con.

Cards & bottles (20 ea. per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
63-18	1/18/63	17°50'	149°47'					
63-19	1/22/63	15°57'	149°47'					
63-20	2/ 6/63	18°09'	149°49'					
63-21	2/ 9/63	15°16'	149°51'					
63-22	2/11/63	15°15'	150°09'					
63-23	2/15/63	23°05'	150°08'					
63-24	2/16/63	23°07'	149°55'					
63-25	2/17/63	23°05'	150°03'					
63-26	2/20/63	20°45'	149°50'					
63-27	2/22/63	20°36'	149°56'					
63-28	2/23/63	20°38'	149°51'					

USC&GS SURVEYOR - February 25 - March 4, 1963

Cards (20 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
S-1*	2/25/63	29°56'	180°00'					
S-2*	2/25/63	30°13'	180°00'					
S-3	2/25/63	30°43'	180°00'					
S-4	2/25/63	31°06'	180°00'					
S-5	2/25/63	31°33'	180°00'					
S-6	2/26/63	32°12'	180°00'					
S-7	2/26/63	32°42'	180°00'					
S-8	2/26/63	33°11'	180°00'					
S-9	2/26/63	33°37'	180°00'					
S-10	2/26/63	34°12'	180°00'					
S-11	2/26/63	34°33'	180°00'					
S-12	2/26/63	35°00'	180°00'					
S-13	2/26/63	35°42'	180°00'					
S-14	2/26/63	36°08'	180°00'					
S-15	2/26/63	36°42'	180°00'					
S-16	2/26/63	37°13'	180°00'					
S-17	2/26/63	37°06'	180°00'					
S-18	2/27/63	38°17'	180°00'					
S-19	2/27/63	39°12'	180°00'					
S-20	2/27/63	39°24'	180°00'					
S-21	2/27/63	39°48'	180°00'					
S-22	2/27/63	39°36'	179°48'					
S-23	2/27/63	39°08'	180°00'					
S-24	2/27/63	39°05'	180°00'					
S-25	2/27/63	38°44'	180°00'					
S-26	2/27/63	38°01'	180°00'					
S-27	2/27/63	37°40'	180°00'					
S-28	2/27/63	37°18'	180°00'					
S-29	2/27/63	36°59'	179°48'					
S-30	2/28/63	36°29'	179°47'					
S-31	2/28/63	36°00'	179°47'					
S-32	2/28/63	35°28'	179°48'					
S-33	2/28/63	35°06'	179°48'					
S-34	2/28/63	34°38'	179°28'					
S-35	2/28/63	34°42'	179°48'					
S-36	2/28/63	33°56'	179°48'					
S-37	2/28/63	33°35'	179°48'					
S-38	2/28/63	33°04'	179°48'					
S-39	2/28/63	32°48'	179°48'					
S-40	2/28/63	32°09'	179°48'					

* 5 cards released in lot.

USC&GS SURVEYOR - February 25 - March 4, 1963--Con.

Cards (20 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
S-41	2/28/63	31°41'	179°48'					
S-42	3/ 1/63	31°13'	179°48'					
S-43	3/ 1/63	29°43'	179°48'					
S-44	3/ 1/63	30°15'	179°48'					
S-45	3/ 3/63	30°20'	179°48'					
S-46	3/ 3/63	30°50'	179°48'					
S-47	3/ 3/63	31°21'	179°48'					
S-48	3/ 3/63	31°59'	179°48'					
S-49	3/ 3/63	32°42'	179°48'					
S-50	3/ 3/63	32°48'	179°48'					
S-51	3/ 3/63	33°48'	179°48'					
S-52	3/ 3/63	33°08'	179°48'					
S-53	3/ 3/63	34°22'	179°48'					
S-54	3/ 3/63	34°53'	179°48'					
S-55	3/ 3/63	35°26'	179°48'					
S-56	3/ 3/63	35°36'	179°48'					
S-57	3/ 4/63	36°17'	179°48'					
S-58	3/ 4/63	36°41'	179°48'					
S-59	3/ 4/63	37°12'	179°48'					
S-60	3/ 4/63	37°38'	179°48'					
S-61	3/ 4/63	38°45'	179°48'					

USC&GS SURVEYOR - March 29 - April 17, 1963

Cards (20 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
S-62	3/29/63	30°02'	170°46'					
S-63	3/30/63	30°31'	170°46'					
S-64	3/30/63	31°02'	170°46'					
S-65	3/30/63	31°30'	170°47'					
S-66	3/30/63	32°02'	170°48'					
S-67	3/30/63	32°36'	170°47'					
S-68	3/30/63	33°06'	170°47'					
S-69	3/30/63	33°36'	170°48'					
S-70	3/30/63	34°06'	170°48'					
S-71	3/30/63	34°21'	170°48'					
S-72	3/30/63	34°36'	170°48'					
S-73	3/30/63	35°05'	170°48'					
S-74	3/30/63	35°09'	170°48'					
S-75	3/31/63	36°24'	170°48'					
S-76	3/31/63	36°48'	170°48'					
S-77	3/31/63	37°07'	170°48'					
S-78	3/31/63	37°32'	170°48'					
S-79	3/31/63	38°00'	170°48'					
S-80	3/31/63	38°06'	170°48'					
S-81	3/31/63	39°06'	170°51'					
S-82	3/31/63	39°30'	170°51'					
S-83	3/31/63	39°50'	170°52'					
S-84	3/31/63	39°50'	171°03'					
S-85	4/15/63	38°06'	172°09'					
S-86	4/15/63	38°04'	172°18'					
S-87	4/16/63	37°50'	172°18'					
S-88	4/16/63	37°24'	172°18'					
S-89	4/16/63	36°54'	172°18'					
S-90	4/16/63	36°36'	172°17'					
S-91	4/16/63	35°54'	172°16'					
S-92	4/16/63	35°24'	172°15'					
S-93	4/16/63	34°55'	172°14'					
S-94	4/16/63	34°25'	172°13'					

USC&GS SURVEYOR - March 29 - April 17, 1963--Con.

Cards (20 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
S-95	4/16/63	34°00'	172°13'					
S-96	4/16/63	34°30'	172°12'					
S-97	4/16/63	33°00'	172°12'					
S-98	4/16/63	32°30'	172°12'					
S-99	4/16/63	32°01'	172°10'					
S-100	4/17/63	31°01'	172°07'					
S-101	4/17/63	30°30'	172°07'					

CHARLES H. GILBERT CRUISE 64 - April 9-14 and April 24-29, 1963

Cards (20 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
64-1	4/ 9/63	21°19'	158°07'	1	6/22/63	21°17'	157°42'	Oahu
64-2	4/ 9/63	21°05'	158°15'					
64-3	4/ 9/63	20°52'	158°29'					
64-4	4/ 9/63	20°40'	158°43'					
64-5	4/ 9/63	20°26'	158°56'					
64-6	4/10/63	20°14'	159°10'					
64-7	4/10/63	20°06'	159°09'					
64-8	4/10/63	20°03'	158°51'					
64-9	4/10/63	20°03'	158°34'					
64-10	4/10/63	20°04'	158°16'					
64-11	4/10/63	20°03'	158°13'					
64-12	4/10/63	19°55'	158°29'					
64-13	4/10/63	20°30'	158°32'					
64-14	4/11/63	20°10'	158°17'					
64-15	4/11/63	20°31'	158°17'					
64-16	4/11/63	20°09'	158°18'					
64-17	4/11/63	20°10'	158°36'					
64-18	4/11/63	20°28'	158°43'					
64-19	4/11/63	20°32'	158°31'					
64-20	4/11/63	20°32'	158°31'					
64-21	4/12/63	20°12'	158°25'					
64-22	4/12/63	20°08'	158°42'					
64-23	4/12/63	20°09'	158°46'					
64-24	4/12/63	20°11'	158°31'					
64-25	4/13/63	20°01'	158°50'					
64-26	4/13/63	20°01'	158°50'					
64-27	4/13/63	19°51'	158°40'					
64-28	4/13/63	20°09'	158°38'					
64-29	4/13/63	20°24'	158°33'					
64-30	4/14/63	20°08'	158°41'					
64-31	4/14/63	20°22'	158°12'					
64-32	4/14/63	20°31'	158°09'					
64-33	4/14/63	20°39'	158°06'					
64-34	4/14/63	20°50'	158°03'					
64-35	4/26/63	21°05'	158°08'					
64-36	4/26/63	20°53'	158°23'					
64-37	4/26/63	20°41'	158°12'					
64-38	4/26/63	20°45'	158°30'					
64-39	4/26/63	20°48'	158°50'					
64-40	4/26/63	20°39'	158°35'					
64-41	4/26/63	20°32'	158°21'					
64-42	4/27/63	20°35'	158°41'					
64-43	4/27/63	20°31'	158°45'					
64-44	4/27/63	20°23'	158°30'					
64-45	4/27/63	20°21'	158°48'					
64-46	4/27/63	20°15'	158°58'					
64-47	4/27/63	20°10'	158°41'					

CHARLES H. GILBERT CRUISE 64 - April 9-14 and April 24-29, 1963--Con.

Cards (20 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
64-48	4/27/63	20°10'	158°51'					
64-49	4/27/63	20°10'	158°53'					
64-50	4/27/63	20°10'	158°54'					
64-51	4/28/63	20°11'	158°52'					
64-52	4/28/63	20°10'	158°56'					
64-53	4/28/63	20°10'	158°55'					
64-54	4/28/63	20°09'	158°55'					
64-55	4/28/63	20°09'	158°56'					
64-56	4/28/63	20°09'	158°57'					
64-57	4/29/63	20°10'	158°56'					

USC&GS SURVEYOR - May 7 - May 15, 1963

Cards (20 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
S-102	5/ 7/63	30°00'	180°00'					
S-103	5/ 7/63	30°36'	179°24'					
S-104	5/ 7/63	30°54'	178°54'					
S-105	5/ 7/63	31°18'	178°36'					
S-106	5/ 8/63	31°42'	178°02'					
S-107	5/ 8/63	32°00'	177°08'					
S-108	5/ 8/63	32°24'	177°24'					
S-109	5/ 8/63	32°36'	177°47'					
S-110	5/ 8/63	32°54'	178°12'					
S-111	5/ 8/63	33°00'	178°03'					
S-112	5/ 8/63	33°18'	178°48'					
S-113	5/ 8/63	33°36'	179°21'					
S-114	5/ 8/63	33°54'	179°48'					
S-115	5/ 8/63	34°00'	180°00'					
S-116	5/ 8/63	34°06'	179°07'					
S-117	5/11/63	34°02'	180°00'					
S-118	5/11/63	35°00'	180°00'					
S-119	5/12/63	36°00'	180°00'					
S-120	5/13/63	36°07'	179°43'					
S-121	5/13/63	36°36'	179°24'					
S-122	5/13/63	37°00'	179°06'					
S-123	5/13/63	37°24'	178°36'					
S-124	5/14/63	37°54'	178°42'					
S-125	5/14/63	38°00'	178°00'					
S-126	5/14/63	38°42'	177°30'					
S-127	5/14/63	39°00'	177°06'					
S-128	5/15/63	39°12'	176°55'					
S-129	5/15/63	38°54'	177°00'					
S-130	5/15/63	39°24'	177°24'					
S-131	5/15/63	39°42'	178°00'					
S-132	5/15/63	39°42'	178°49'					
S-133	5/15/63	39°48'	179°18'					
S-134	5/15/63	40°00'	180°00'					
S-135	5/15/63	40°05'	179°55'					
S-136	5/15/63	40°12'	179°30'					
S-137	5/15/63	40°54'	179°12'					
S-138	5/15/63	41°18'	178°54'					
S-139	5/15/63	41°50'	178°30'					

CHARLES H. GILBERT CRUISE 66 - June 7 - June 23, 1963

Cards (20 per batch) release batch no.	Release data			Recovery data				
	Date	Lat. (N.)	Long. (W.)	Number returns	Date	Lat. (N.)	Long. (W.)	Locality
66-1	6/ 8/63	21°14'	153°33'					
66-2	6/ 9/63	20°21'	153°26'					
66-3	6/ 9/63	19°26'	153°22'					
66-4	6/ 9/63	18°58'	153°21'					
66-5	6/ 9/63	18°30'	153°26'					
66-6	6/ 9/63	18°02'	153°24'					
66-7	6/ 9/63	17°35'	153°18'					
66-8	6/ 9/63	17°08'	153°17'					
66-9	6/10/63	16°40'	153°16'					
66-10	6/10/63	16°13'	153°16'					
66-11	6/10/63	15°55'	153°25'					
66-12	6/10/63	15°30'	153°24'					
66-13	6/10/63	16°00'	153°26'					
66-14	6/11/63	16°02'	153°22'					
66-15	6/12/63	16°08'	153°18'					
66-16	6/12/63	16°07'	153°16'					
66-17	6/13/63	16°10'	153°15'					
66-18	6/13/63	16°11'	153°14'					
66-19	6/14/63	16°18'	153°12'					
66-20	6/15/63	16°27'	153°08'					
66-21	6/16/63	16°41'	152°58'					
66-22	6/17/63	16°41'	153°01'					
66-23	6/17/63	16°20'	153°12'					
66-24	6/17/63	16°20'	153°12'					
66-25	6/18/63	15°27'	153°14'					
66-26	6/18/63	15°15'	153°14'					

MS #1392

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES
WASHINGTON, D.C. 20240

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